Featuring Ignition Systems

AUTOMOBILE

Vol. XXXV
No. 23

NEW YORK, DECEMBER 7, 1916

Ten cents a copy
Three dollars a year

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Stewart Products

Winter Business Leaders

Stewart Products are the leaders all the year 'round. They are 365-day-in-the-year sellers—sold 52 weeks running—straight through 12 months.

Stewart Products know no seasons—motorists *need* and *buy* them in winter and summer.

For example, there is the Stewart-Warning Signal—an absolute necessity for winter driving. In winter motorists are driving, all muffled up in heavy clothing, side curtains up, or with a winter top. Oftentimes the vision is obscured by snow and sleet. Then, the efficient, far-sounding Stewart Warning Signal is the only safe-guard.

Dealers can sell every motorist a Stewart Warning Signal by merely pointing out how necessary it is.

And the other Stewart Products—the Speedometer, Vacuum System, Tire Pump, Spark Plug—are all just as necessary in winter.

Live dealers will do a *big* Winter Business with Stewart Products.

Stewart PRODUCTS

PRESTIGE QUALITY SERVICE SATISFACTION MADE IN U.S.A.

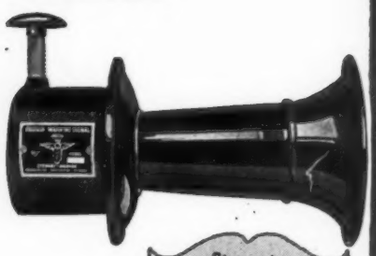
STEWART-WARNER SPEEDOMETER CORP.

Chicago, U. S. A.

Stewart Speedometer for Fords $10

Stewart Motor Driven Warning Signals $6

Stewart Tire Pump $12



Stewart Hand Operated Warning Signal $3.50

Stewart Speedometer $25

Stewart V-Ray Spark Plug $1

Warner Auto-Meter $50

Stewart Vacuum System $10

The AUTOMOBILE

VOL. XXXV NEW YORK, THURSDAY, DECEMBER 7, 1916—CHICAGO No. 23

Any State May Tax Non-Residents

N. J. Motor Laws Upheld by U. S. Supreme Court in Case Against F. J. Kane

WASHINGTON, D. C., Dec. 4—The United States Supreme Court in a decision to-day established the right of any State to tax non-resident automobile owners for the use of their roads. The decision is of national import in that it lays the way open to changes in the laws of those States which should decide to take advantage of to-day's ruling.

According to the decision, a State may impose a tax on the use of non-resident automobiles, rather than upon the machines themselves, to compensate for the wear and tear on highways.

The decision was the result of the arrest of F. J. Kane of New York for operating an automobile in New Jersey without registering his car there. The case was based on the violation of three provisions of the New Jersey law; first that Kane had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney. The last provision was to enable residents who had suffered injury at the hands of non-resident motorists, to prosecute their claims for redress in that State instead of being compelled to follow the non-resident to his home State, wherever that might be.

Both New Jersey and Maryland impose a graduated license tax, on both residents and non-residents, based upon horsepower. In January, 1915, the Supreme Court upheld the Maryland statute as not burdensome on interstate commerce, but in the New Jersey case the contention was made that the taxes were not solely for adminstration costs of regulation and registration of automobile traffic, as was the case in Maryland.

The law in question is that of 1906, as amended in 1908 and known as the Freylinghuysen law, which has been since considerably modified. Though New Jersey has, since the litigation started, adopted reciprocal legislation as to visiting motorists, the decision, really a test case, may change the laws of the States, even going so far as to nullify all reciprocal relations between the various States.

Charles Thaddeus Terry, well known New York lawyer, who has been an able exponent of rational automobile legislation in the East, claims that this decision, relating to non-resident registration only, does not affect the greater argument as to whether a resident motorist should be required to pay a tax greater than the bare cost of registration. This question has yet to be settled.

—

Collins Is Chevrolet Sales Manager

NEW YORK., Dec. 1—J. S. Collins has become sales manager of the Chevrolet Motor Co. of Michigan, with headquarters at the Flint factory. Mr. Collins succeeds F. K. Lane, resigned, and will have charge of the territory embracing the states of Michigan, Indiana and Ohio and portions of Wisconsin, Illinois, Kentucky, West Virginia, Pennsylvania and New York.

He spent 13 years with the International Harvester Co., passing through several promotions and reaching the post of assistant general agent at Jackson.

—

Promotions at Chalmers

DETROIT, Dec. 4—E. C. Morse, vice-president in charge of the sales for the Chalmers Motor Corp., has been appointed general manager of the company. W. P. Kiser, treasurer, has been promoted to secretary and assistant general manager. D. T. Turnbull succeeds Mr. Kiser as treasurer.

White Four Has 16 Valves

Plain-Bearing Crankshaft, Unit Power Plant and Center Brake Lever Features

CLEVELAND, Dec. 4.—Summing up engine performance as a matter of valve efficiency, the engineering department of the White Motor Co., Cleveland, has evolved and is just about to start production on a sixteen-valve four. Accompanying the new model there are a number of other innovations on the chassis which are notable departures from previous White practice.

This is the first White unit power plant, and it incorporates a plain bearing crankshaft instead of the ball-bearing design which is continued on the other models. The cylinders have removable heads, the oil is carried in the lower part of the aluminum crankcase instead of in a dash reservoir, and the entire appearance of the unit does not resemble previous products in any way.

Many Refinements

All through the chassis are a number of alterations which mark advancement in design. There is a cane type of gearshift lever, with a standard gate instead of the cross-over shifting arrangement formerly employed. The brake lever is in the center instead of at the left side, allowing a clear passageway through the left front door. The springs are semi-elliptic and the spare tires, instead of being carried in a well on the running board, are now supported on a bracket at the rear. In fact, a score or more of altered details can be located at a glance.

Most of the interest in the new car is focussed on the power plant. Here the lessons learned on the race track

(*Continued on page* 978)

Five Car Companies Raise Prices

Winton, Mitchell, Saxon, Allen and Premier Announce Revised Lists

CLEVELAND, Dec. 4.—The Winton Co. will increase the price of all its models by $200. The raise becomes effective Dec. 15.

—

Mitchell Increases Prices $100

RACINE, WIS., Dec. 1—The Mitchell Motors Co., this city, increased to-day the price of the Mitchell and the Mitchell Junior $100.

—

Saxon Six Price Now $865

DETROIT, Dec. 5—The price of the Saxon six has been increased from $815 to $865, due to the increased cost of labor and materials. The raise takes effect Jan. 1.

—

Premier Raises Car Prices

INDIANAPOLIS, IND., Dec. 1—The Premier Motor Corp., this city, has raised its prices on the seven-passenger touring car and four-passenger roadster from $1,685 to $1,895, on the limousine and town car from $2,950 to $3,150, and on the sedan from $2,685 to $2,900.

—

Allen Raises Closed-Car Prices

FOSTORIA, OHIO, Dec. 5—The Allen Motor Co. will increase the price of its coupé and sedan $100, effective Jan. 1. The new price for the coupé is $1,175 and for the sedan $1,195.

—

Perry Again in America

DETROIT, Dec. 2—P. L. D. Perry, president of the Ford Automobile Co. of Great Britain, is again in this country, following a recent trip to England. Mr. Perry states that the British government has issued orders to automobile makers which prohibit them from manufacturing cars for private persons except under special license.

—

De Lorenzi Sails for England

JACKSON, MICH., Dec. 1—E. A. De Lorenzi, service engineer of the Briscoe Motor Corp., has sailed for England to enter the transportation department of the Allies.

—

Chase Joins S. A. E. Office Staff

NEW YORK, Dec. 5—Herbert Chase has joined the office staff of the Society of Automobile Engineers. He was formerly connected with the Automobile Club of America as laboratory engineer and chief engineer. His new capacity will be that of assistant secretary. He is at present treasurer of the society and a member of its council, and has taken a prominent part in the activities and conduct of the Metropolitan Section.

His preparatory engineering education was had at the Pratt Institute. He was graduated as a mechanical engineer at Sibley College, Cornell University, in 1908.

—

Duryea Forms $4,000,000 Company to Build $250 Car

WILKES-BARRE, PA., Dec. 5—The Duryea Motors, Inc., of which Charles E. Duryea is president, has been formed with a capital of $4,000,000 to build the Duryea Gem at $250. This car will seat three persons. Other features include the Duryea patented roller drive.

Negotiations have been closed for a factory site and the Cutlery Works plant in the southern part of the city has been leased to start manufacturing.

Plans are to open the factory in the immediate future, just as soon as 20,000 shares of the stock, par value $5, is bought by the people of this city.

—

Dennet Resigns from Packard

DETROIT, Dec. 1—M. S. Dennet, chief inspector of the Packard Motor Car Co., has resigned. Mr. Dennet will represent the Muskegon Motor Specialties Co. and the Ajax Forge Co. in Detroit.

Reo Earnings Total $4,031,070

Assets of Car and Truck Cost $11,978,307.98—Surplus $3,849,828.20

LANSING, MICH., Dec. 1—The net earnings of the Reo Motor Car Co. and the Reo Motor Truck Co. for the year ending Aug. 31, 1916, were $4,031,070.26. Current assets were reported as amounting to $7,610,501, with a surplus of $3,849,828.20. Total assets are $11,978,307.98, capital assets amount to $4,277,674.06, and current liabilities are $1,191,229.78. This strong financial position is stated in a balance sheet at the close of business, Aug. 31, 1916.

The current assets show an increase of $2,776,845.36, as compared with the current assets of $4,833,655.75 on Aug. 31, 1915. Other important items mentioned in the report are certificates of deposit of $320,000, cash on hand in banks $1,360,517.97 and inventories of finished product, supplies and materials on hand amounting to $4,904,511.23.

It is thought, among some of the stockholders, that the company's annual meeting on Dec. 19 will witness a large stock dividend distribution, because of the large residue of unissued stock and surplus. The balance sheet follows:

ASSETS

Current assets		$7,610,501.11
Cash on hand and in banks	$1,360,517.97	
Certificates of deposit	320,000.00	
Receivables	1,025,471.91	
Notes receivable	$121,162.00	
Accounts receivable	546,077.28	
Drafts outstanding	421,320.05	
Accrued interest	3,009.16	
	$1,091,768.49	
Less reserves	66,296.58	
	$1,025,471.91	
Inventories	4,904,511.23	
	$7,610,501.11	
Capital assets		4,277,674.06
Land	$235,999.92	
Buildings	1,136,458.34	
Machinery and equipment	2,905,215.80	
	$4,277,674.06	
Deferred charges		16,345.31
Interest in other corporations		73,787.50
		$11,978,307.98

LIABILITIES

Current liabilities		$1,191,229.78
Accounts payable	$1,025,313.68	
Accrued pay roll	82,416.10	
Reserve for taxes	78,500.00	
Other reserves	5,000.00	
	$1,191,229.78	
Capital		10,787,078.20
Capital stock authorized	$11,000,000.00*	
Less unissued	4,062,750.00	
Stock outstanding	$6,937,250.00	
Surplus	3,849,828.20	
	$10,787,078.20	
		$11,978,307.98

*This amount includes the Authorized Capital Stock of both Car and Truck Cos. The purchase of the Truck Co. by the Car Co. eliminated the Truck Co. Stock. Authorized Capital Stock is now that of the Reo Motor Car Co., $10,000,000.00 and Unissued $3,062,750.00.

Overland Men Take 25,925 Cars

2237 Dealers and Guests at Convention Inspect 1917 Models and Plant

TOLEDO, Dec. 6—Willys-Overland dealers closed contracts for 25,925 cars, aggregating more than $20,000,000 in value, during the first 2 days of their annual convention at the factory of the Willys-Overland Co., this city. The new Country Club model proved most popular with the thirty-eight distributors from seventeen States. Dealers and guests numbering 1027 arrived to-day from all parts of the country, bringing the total attendance to date up to 2237.

Anderson and Young Promoted

DETROIT, Dec. 6—Lee Anderson has been appointed vice-president of the commercial division of the Hupp Motor Car Corp., this city, Dubois Young has been appointed vice-president of the manufacturing division of the company. Mr. Anderson, who has been with the company for 2 years, was formerly advertising and commercial manager.

N. A. C. C. Export Conference in January —Nov. Shipments 17,250 Carloads

NEW YORK, Dec. 6—Directors of the National Automobile Chamber of Commerce at their meeting to-day voted to hold a meeting in January of the export managers of the companies holding membership in the organization. Exports have been increasing every year and the figures for 1916 will exceed $160,000,000.

Notwithstanding the shortage in freight cars, which has seriously affected the industry, shipments of automobiles for November were 17,250 carloads as against 17,138 for the same month last year. Report was made at the investigation of the Interstate Commerce Commission regarding the rules and practices of railroads taking interchange of cars, and it was clearly shown that this service has been seriously impaired by the cars being arbitrarily used in other services. It was also reported that a committee of presidents of the American Railway Assn. had agreed to establish at Washington a conference committee on car efficiency, consisting of five operating officials to co-operate with the Interstate Commerce Commission in an effort to relieve the freight car shortage.

It is expected that the railroads will soon advance their per diem charge for the use of freight cars by other roads from 45 cents to $1.00 or $1.25 per day.

Charles Clifton, president of the N. A. C. C., gave his annual complimentary dinner to the directors at the Hotel Biltmore last night.

Tener Maxwell Sales Director

DETROIT, Dec. 5—T. J. Tener has become director of sales of the Maxwell Motor Co. He was formerly Pacific Coast zone manager. C. E. Zebbins, formerly sales manager, is now assistant director of sales. Charles Gould, formerly service manager, is now sales manager. G. S. Gamble has been appointed assistant sales manager.

Herschell-Spillman Capital Tripled

NORTH TONAWANDA, N. Y., Dec. 1—The Herschell-Spillman Co., this city, will increase its capital stock on Jan. 1, 1917, from $250,000 to $750,000.

This increase in stock is made necessary in order to provide facilities to take care of the company's increase in business during the past year.

France Heavy Buyer in October

Leads European Countries in Purchase of Cars—United Kingdom Heads List

WASHINGTON, D. C., Dec. 2—Among European countries France was the heaviest buyer of American automobiles in October last, according to export figures compiled by the Department of Commerce. Five hundred and twenty-two cars, valued at $1,782,088, were shipped there during that month. During the corresponding month of last year France imported 298 cars, valued at $912,139, from this country. During the 10 months ended October the shipments of cars to France increased from 5183, valued at $13,038,767, in 1915, to a total of 7019 cars, valued at $18,311,-143, in 1916.

United Kingdom Purchases Decline

Exports of cars to the United Kingdom amounted to 684 machines, valued at $1,687,152, in October last, as against 2021 cars, valued at $2,730,468, in October a year ago. There was a big falling off in the exports during the 10 months' period, the shipments declining from 21,455 cars, valued at $31,379,217, in 1915, to 7959 cars, valued at $13,763,-990 in 1916, a result of war conditions and rulings.

Russia's Gain

Russia did not figure in the export returns last year, but during October last that country imported 116 cars, valued at $287,590, while during the 10 months of this year the imports amounted to 2968 cars, valued at $8,199,-

(*Continued on page* 959)

Exports of Automobiles, Trucks and Parts for October and 10 Previous Months

	October							
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	3,479	$2,749,255	4,880	$3,756,768	34,515	$29,543,227	51,699	$36,049,497
Commercial cars	1,596	4,307,190	1,144	3,635,291	18,865	52,076,406	15,917	44,006,346
Parts, not including engines and tires	....	1,819,950	....	1,949,060	.....	12,814,809	.....	20,091,793
	5,075	$8,876,395	6,024	$9,341,119	53,380	$94,434,432	67,616	$100,147,636
By Countries								
Denmark	....	.....	342	$241,020	.....	.....	1,305	$955,432
France	298	$912,139	522	1,782,088	5,183	$13,038,767	7,019	18,311,143
Germany	....	.....	....	.....	4	2,800	.....	.....
Italy	40	25,887	7	7,517	210	134,901	244	151,484
Russia	....	.....	116	287,590	.....	.....	2,968	8,199,997
United Kingdom	2,021	2,730,468	684	1,687,152	21,455	31,379,217	7,959	13,763,990
Other Europe	814	1,920,176	301	327,196	7,502	20,003,140	3,403	4,194,615
Canada	189	202,552	1,021	718,962	5,238	4,154,137	11,118	8,025,079
Mexico	13	12,250	129	94,089	88	84,141	539	467,976
West Indies and Bermuda	267	173,355	665	505,198	2,625	1,478,360	4,704	3,152,389
South America	383	210,840	....	.....	2,464	1,277,326	.....	.....
Argentina	....	.....	302	195,512	.....	.....	4,258	2,206,709
Brazil	....	.....	44	33,046	.....	.....	348	232,860
Chile	....	.....	195	158,719	.....	.....	1,075	712,748
Venezuela	....	.....	36	23,781	.....	.....	447	284,316
Other South America	....	.....	113	64,986	.....	.....	816	509,877
British East Indies	....	.....	329	223,543	.....	.....	3,430	2,507,789
Australia	....	.....	347	274,073	.....	.....	7,025	5,361,054
British Oceania	447	360,260	....	.....	3,594	3,041,852	.....	.....
Asia and other Oceania	295	284,063	595	554,648	3,245	5,474,001	7,402	8,550,494
Other countries	308	224,455	276	212,939	1,772	1,550,991	3,556	2,467,891
	5,075	$7,056,445	6,024	$7,392,059	53,380	$81,619,633	67,616	$80,055,843

$10,000,000 in Cars Held Up

Makers May Suspend Manufacturing if Relief Is Not Forthcoming

DETROIT, Dec. 2—More than $10,000,000 worth of automobiles are held up awaiting freight cars for shipment. Many automobile makers will be forced to suspend manufacture if relief is not immediately forthcoming. These were statements made yesterday at a meeting of the traffic committee of the National Automobile Chamber of Commerce held in Detroit.

The committee named two committees who will visit railroad officials throughout the Central Freight Association territory and in the East to urge compliance with the Interstate Commerce Commission's recommendation that automobile cars be returned promptly to their home lines.

Traffic men named on the committees include H. R. Moule of the Chalmers Motor Car Co., A. C. Westfall of the Cadillac Motor Car Co., C. W. Eggers of the Willys-Overland Co., J. R. Graham of the Reo Motor Car Co., H. M. Newlin of the Maxwell Motor Co. Mr. Eggers is chairman of the traffic committee.

"There are approximately 30,000 automobile freight cars in the Central Freight Association territory and on Eastern trunk lines that are being used for all kinds of shipments other than automobiles," stated Mr. Eggers, following yesterday's meeting, "and we shall try to obtain the return of these cars. We shall point out to the railroad officials the recommendation made by the Interstate Commerce Commission in connection with its order calling for a redistribution of freight cars, to the effect that automobile cars should be returned to their home lines. Unless we can get some action in this matter it is probable that many car factories will have to suspend operations for a time at least."

—

Freight Car Shortage Necessitates Urgent Relief

NEW YORK, Dec. 4—Nation-wide redistribution of box cars is required by a new order agreed upon by the railroad conference committee on car efficiency in its campaign to relieve the car shortage which is seriously holding up freight in all parts of the country. By this order box cars will be diverted from parts of the country where they are not needed, to the West, Northwest, South and Southwest, where there is urgent need for them. The instructions issued refer to box cars, loaded or empty.

As an emergency measure the railroad authorities at Washington have authorized the railroads to establish and maintain until May 1 a new progressive demurrage scale higher than the present flat rate of $1 a day. Under the new scale 2 free days are allowed, and subsequent charges are $1 for the third, $2 for the fourth, $3 for the fifth day, and $5 for the sixth and each day thereafter.

Apropos of the redistribution plan, railroads in New England are to turn over to their Southern and Western connections 30 per cent more box cars than they receive from those lines. Railroads in what is known as the trunk line and central freight territory, regardless of the number of box cars on their lines, must deliver to their Southern and Western connections 20 per cent more box cars than received from them.

—

Car Shortage Felt at Flint

DETROIT, Dec. 4—The Chevrolet Motor Co. has been forced to double deck the ordinary freight cars, shipping cars in many pieces in order to load them, and putting six cars in a freight car instead of three as ordinarily, in its efforts to overcome the freight car shortage. Every automobile maker in Flint is suffering from the shortage. Incoming freight shipments are piled up at the various freight receiving sheds. Railroads are making every effort to relieve the congestion.

—

November Jeffery's Biggest Month

KENOSHA, WIS., Dec. 2—During the first 3 months of the Nash Motors Co. régime, all sales records have been broken. November was the biggest sales month in the history of the company. During that month, its books showed an actual increase of 381 per cent over the corresponding month last year.

—

Batavia Rubber Complains of Discriminating Freight Rates

WASHINGTON, Dec. 6—The Batavia Rubber Co., Batavia, N. Y., has filed complaint with the Interstate Commerce Commission charging the Atlantic Coast Line Railroad, and connecting lines, with discrimination in rates with respect to its articles of manufacture on shipments meant for so-called Southern Classification territory by way of Ohio River crossings.

The complaint alleges that this discrimination extends to classes of tires as follows:

First class, on pneumatic tires, in any quantity; second class on solid tires, any quantity; and, first class, on all others, such as tires in steel casings.

The complainant asks the commission to order rates which will cause "a larger spread" between the carload, and less than carload lots.

Goodyear Profits $7,003,330

Sales During Company's 1916 Fiscal Year Total $63,950,399

AKRON, Dec. 6—Sales of $63,950,399.52 during the past year are reported by the Goodyear Tire & Rubber Co., this city, in the year ending Oct. 31, 1916. This compares with $36,490,651.64 for the preceding year. Net profits were $7,003,330 as against $5,189,528 for the preceding year. There remains an unappropriated surplus of $2,253,166.87. Cash dividends during the year amounted to $764,239.28 on the preferred and $1,261,332 on the common. Stock dividends amounted to $8,427,000. To meet the demand for its products, the company added more fixed capital, which was provided for by the sale of $17,500,000 of preferred, having previously retired $6,650,000 of preferred then outstanding. A stock dividend of 100 per cent out of accumulated surplus was distributed, after paying the regular cash dividends, 7 per cent on the preferred and 12 per cent on the outstanding common.

In its balance sheet the company shows total assets amounting to $49,217,794, total liabilities of $9,167,973, thus leaving an excess of assets over liabilities of $40,049,820.

—

Reo Drives 70 Per Cent of Cars

LANSING, MICH., Dec. 4—The Reo Motor Car Co. is driving more than 70 per cent of its output to dealers within a radius of 1000 miles in order to overcome the scarcity of freight cars, and up to the present has been fortunate enough to escape great hardship. The company plans to use flat cars when severe Winter weather prevents driving.

—

Post Tire Buys Plant

ST. LOUIS, Dec. 2.—The Post Tire and Rubber Corp, recently incorporated for $1,500,000, has bought the plant of the Union Tire & Rubber Co., this city, and will immediately begin operations. The plant consists of a two-story brick structure with a total floor space of 70,000 sq. ft.

—

Grant Moves to Cleveland

CLEVELAND, Dec. 1—The Grant Motor Car Corp. marks the opening of its fourth year of growth, by removal from Findlay, Ohio, to its great new factory at Coit and Kirby Avenues, Cleveland.

The new Grant home is a model of modern efficient factory construction

and arrangement. The length is 600 ft.; the width 250 ft., and the floor space, 150,000 sq. ft. It has an annual capacity of 35,000 cars.

The factory is a unit. Every department, while separate, and distinct, is within easy access of the other departments with which its work is closely connected. The car while building passes from department to department quickly. By means of a conveyor system, the final car assembly may be completed in less than 10 min. The factory stands on a 7-acre tract.

—

Apperson in New Factory

KOKOMO, IND., Dec. 4—The Aperson Bros. Automobile Co., this city, has just finished moving into its new group of factory buildings. Its plant is modern in every respect.

—

Turnbull Wagon Adds Bodies

DEFIANCE, OHIO, Dec. 4.—The Turnbull Wagon Co. has added an automobile body department. This will be operated independently of the wagon factory.

—

Dorris Discontinues 1500-Pounder

ST. LOUIS, MO., Dec. 1—The Dorris Motor Car Co., this city, has discontinued the manufacture of its 1500-lb. delivery wagon.

—

Fitch, Tractor Inventor, Dead

BIG RAPIDS, MICH., Dec. 2—John H. Fitch, inventor of the four-drive tractor and president of the Four Drive Tractor Co., Inc., Big Rapids, died Nov. 24, after a brief illness. His office is filled automatically by E. J. Jenkins, who will continue also as general manager.

Timken Co-Operative Store

—

Employees of Axle Company Organize to Secure Benefits of Wholesale Prices

DETROIT, MICH., Dec. 1—Employees of the Timken-Detroit Axle Co. have organized a co-operative store for the purpose of reducing the high cost of living. For the present the store benefits will be confined to married employees, but it is planned to enlarge the establishment in the near future so that any employee may participate. Married employees will, temporarily, have to be in the employ of the firm for 6 months to be eligible. Outsiders will never be allowed to make purchases in the store.

The business will be operated entirely by employees though sanctioned and furthered by the company. L. R. Judson, head of the welfare department and temporary chairman and manager of the store, originated the idea. His first step was to write a letter to each of the eligible workers, asking them if they would like to save from 7 to 8 cents a pound on coffee. The letter was sent to feel out the employees on the subject and they were given 1 day to respond. More than 250 lb. were ordered and the plan saved the employees the amount promised, thus effectually giving the scheme its needed impetus.

A temporary structure is being erected to be used for the store and a permanent one will be built later. Orders have already been filled for tea, saving 14 cents on a 50-cent brand, and on apples saving 20 cents on a regular $2 grade. Canned goods, butter, eggs, corn meal and other staples will also be sold. A large saving on everything will be effected.

The store will start with 200 employees for membership and includes in its organization L. R. Judson, chairman and manager; G. W. Veal (assistant to general manager), acting secretary and treasurer, and W. R. McKay (superintendent), E. Rutter (material superintendent), and G. E. Holmes (carpenter foreman), executive committee.

—

Studebaker Plans 200,000 Car Output

DETROIT, Dec. 5—The Studebaker Corp. is making plans for a production of 200,000 cars yearly and the employment of 20,000 men, with an aggregate yearly business of $100,000,000, within the next 2 years. The company employs 8000 workers at present.

—

Buick Builds 563 Cars Daily

FLINT, MICH., Dec. 5—The Buick Motor Co., this city, has been turning out 563 cars daily in the past 8 working days. During November, 10,430 cars were shipped and 10,700 manufactured.

—

Stout Plans Aeroplane Clubs

DETROIT, Dec. 4—W. B. Stout, manager of the aircraft division of the Packard Motor Car Co., plans to organize model aircraft clubs in all of the Detroit high schools. Mr. Stout organized a similar club in Chicago under the name of the Model Aero Club of Ill. The organization developed aeroplanes from models. It is planned through the new club to be organized here, to bring all of the different Detroit organizations interested in aviation together annually in competition.

Aviation Experts Gathered Together on Joy Field

This illustration is from a photograph taken at the Aviation Field owned by Henry B. Joy of Detroit. The field is located near Mt. Clemens, Mich., on the shores of Lake St. Clair. From left to right the men are as follows: W. H. Hutton; Henry B. Joy; Charles B. King; Dr. H. C. Dickinson, Bureau of Standards, Washington, D. C.; Lieut. Col. George O. Squier, Officer in Charge of Aviation; Eugene Lewis; Dr. W. Stratton, Director of Bureau of Standards; Henry Souther, Consulting Engineer United States Army; Dr. Charles F. Marvin, Chief of Weather Bureau, Washington, D. C.; Howard E. Coffin; S. D. Waldon; Lieut. W. G. Child, United States Navy; Roy D. Chapin; Dr. Charles D. Walcott, Sec. Smithsonian Institute, and Russell Huff

Is Scare Advertising Potential?

W. B. Lashar, of Weed Chain, Advances Arguments in Favor of Such Copy

NEW YORK, Dec. 1—Whether scare advertising copy is potential copy or not is a question that may be settled in the not distant future. When the National Automobile Chamber of Commerce, Inc., appointed its committee to discourage scare advertising, one of the concerns it had in mind was the American Chain Co., manufacturer of Weed anti-skid chains. Walter B. Lashar, president of this concern, has taken up the defense of scare copy on the ground that it is positive advertising rather than negative, and he believes his advertising thus performs a public service.

One of the pertinent examples cited by Mr. Lashar is that a manufacturer of fire extinguishers that have real merit, who puts out scare copy does not thus make people give up living in houses, but makes them more keen for fire-proof construction. Mr. Lashar asks the question: "Does such copy make people scoff at the dangers of fire, make them more reckless than ever, or does it bring home to the individual a vivid realization of a fire in his home and make him insist that every possible precaution be taken to prevent fires?"

Continuing his arguments in favor of scare copy, Mr. Lashar says:

"Scare copy is like any other copy; it can be good or bad or merely negative. There is only one standard by which 'scare' copy can be judged: The criterion is not what it does *to* the public but what it does *for* the public.

"If scare copy plays upon the credulity, the superstition, the helplessness, the cupidity of people, merely to coin these weaknesses into money without regard to the harm that is being done; if this copy is a lie in spirit or in fact; if it increases real suffering and misery, by dwelling upon an evil for which there is no prevention and no remedy—then it is a crime to use such copy. But scare copy that is true, that brings home to each individual a consciousness of his own personal responsibility for a real evil that is a constant menace—a reality that exacts a frightful toll in human lives and in human suffering—and points out a direct and effective remedy that ordinary intelligence can use, such scare copy is doing a great public service.

"It is true that this 'scare' copy may make a few hundred neurasthenics a little more miserable, but the real evil is in the neurasthenia, not in the copy. The logical effect of this scare copy is to make a thousand people more careful to safeguard against troubles. The measure of the worth of such copy has not its effect upon a relatively small group of people but its effect upon the public as a whole.

"The manufacturer uses scare copy because it sells his product. Selling is the most important factor in his business. A manufacturer whose selling plan makes money for himself, and at the same time is of great and definite benefit to the public, including the part of the public that does not buy his product, seems to me to be a more real philanthropist, a more valuable philanthropist than one who gives a certain sum of money for a particular work.

"The simple truth is that scare copy is the only kind that jars some of us out of our complacent self-sufficiency, our fixed habits of carelessness, our blind delusions, that we will get through somehow, our disposition to take a gambler's risks."

Mr. Lashar finishes with the following: "These are some of the reasons why we continue to use intelligent, constructive scare copy, the object of which is to make motoring safe and secure, under all road conditions, for all those who use the road, whether they travel in cars, on foot, or by horse. So long as scare copy benefits the public infinitely more than it can profit any company, such a company can afford to let any interest that feels itself antagonized by such copy fight out the issue with the public."

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Moto-Meter Enjoins Heat-Ometer

NEW YORK, Dec. 1—A preliminary injunction prohibiting sale of the Heat-Ometer radiator indicator and use of the word Heat-Ometer has been granted on complaint of the Moto-Meter Co., Inc., maker of the Boyce Moto-Meter. Suit was brought against the Times Square Automobile Co., which had been selling Heat-Ometer, the Moto-Meter Co. alleging that the device infringed its product and that the use of the word Heat-Ometer infringed the trade mark Moto-Meter.

The Heat-Ometer, made by the Heat-Ometer Co., Inc., New York, consists of a diamond-shaped frame holding a glass indicator tube containing a sensitive liquid which is pink at normal temperature but turns deep purple when a dangerous degree of heat is reached. Like the Boyce Moto-Meter, the Heat-Ometer is mounted on the radiator cap. The suit was in the U. S. district court for the southern district of New York.

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Ford Suit in Judge's Hands

DETROIT, Dec. 1.—The suit instituted by Dodge Bros. against the Ford Motor Co. to restrain the latter from further expansion is now in the hands of the judges, who have taken the case under advisement for an early decision.

70% of Accidents at Crossroads

Sec. of State Hugo, of N. Y., Finds Fatalities Measured by Driver's Carelessness

ALBANY, N. Y., Dec. 2—That approximately 70 per cent of fatal automobile accidents are due to careless driving at street and road intersections, according to the coroner's report, is pointed out by Secretary of State Hugo, who has made a study of the traffic conditions accompanying such accidents.

There seems to have been little difficulty where cars travel along intersecting roads of unequal importance, owing to the established custom that the car on the less important road must approach the main highway with special caution, a practice expected by those moving rapidly on the more important thoroughfare. The real difficulty arises when crossroads are of equal importance with the result that drivers approach rapidly from both directions, each considering himself entitled to the exercise of caution by the other driver. There seems to be an increase in the number of instances where misunderstandings based on reasoning of this kind leave the driver to take chances by approaching intersections at high speed. Though the law requires drivers to slow down and signal for crossroads comparatively few observe these rules, thus enhancing the risk of accident. Secretary Hugo considers that too great reliance is frequently placed by automobilists on the power of their brakes to stop their cars quickly. This is unwise, he says, because the driver may, and frequently does, misjudge his speed and other surrounding conditions.

More Care Required

Dangerous crossroads or those of congested area are usually protected by traffic police during the daytime. After these hours, however, these points present problems in accident prevention which are constantly growing more difficult with the increasing number of automobiles and other vehicles traveling these thoroughfares.

Unless some steps are taken to compel all drivers to approach crossroads of equal prominence with the greatest care, Secretary Hugo fears that accidents of this kind will become more frequent and more serious. Warning signals might provide a certain amount of protection at such points, although these are not sufficiently effective in all cases, particularly, as there is nothing to prevent deaf persons from operating cars. The only satisfactory solution of the problem is the use of care by each individual driver when approaching such intersections.

Denmark Likes U. S. A. Cars

Consul General Winslow Reports Demand for Cars and Trucks Increasing

NEW YORK, Dec. 4—The automobile business in Denmark is in a brilliant condition at the present time, according to E. D. Winslow, consul general of the United States to Denmark. Mr. Winslow has returned only recently from that country and states that the demand for cars in that country has increased to such an extent during the past 2 years that the supply is entirely inadequate. People are prosperous on account of the high prices paid for their products due to the war, and the excellent road conditions and attractive touring possibilities of the country naturally make the purchase of a car the logical sequence.

Motor trucks have never before been in as great demand in Denmark as at the present time since the unusually high prices paid for horses by the belligerant nations have induced a very large percentage of the horse owners to part with their animals. Since the labor thus lost must be made up, motor trucks are being bought in large numbers to do the work formerly performed by the horses. On the farms the use of motor tractors has increased rapidly and it is very probable that these machines will be in still greater demand in the future.

The obnoxious laws, which formerly limited automobile touring in Denmark, have either been repealed or so modified that it is now possible to travel throughout the country just as freely as in other lands.

Most Cars Represented

Most of the leading American car manufacturers are now represented in Denmark and Mr. Winslow recommends that any car or accessory maker desirous of entering the Danish field secure special agents. There are now more dealers in Denmark than ever before, about fifty being located in Copenhagen. The people have taken kindly to American cars and accessories and at the present time our manufacturers have this market almost to themselves. If the quality of the American products is maintained and the service rendered by the manufacturers' representatives is satisfactory, this market should be continued after the war.

Very little data can be secured at present in regard to automobile imports into Denmark. The only statistics available, those for the years 1912 and 1913 appearing in tabular form below are in the form of weight of cars, chassis and parts in pounds, trucks not being segregated. These statistics serve to indicate how small these imports were before the beginning of the war.

Imported Into Denmark

COMPLETE CARS

From	1913 Lb.	1912 Lb.
Germany	979,000	765,380
Great Britain	264,000	214,500
Sweden	43,780	10,340
Belgium	36,960	7,480
France	240,020	221,320
United States	201,300	115,280
Other Countries	17,820	13,420
Total	1,782,880	1,347,720

CHASSIS

From	1913 Lb.	1912 Lb.
Germany	64,680	16,720
Great Britain	7,700	11,220
Sweden	6,380	0
France	38,500	5,500
United States	1,980	3,300
Other Countries	0	3,080
Total	119,240	39,820

PARTS

From	1913 Lb.	1912 Lb.
Germany	2,420	1,540
Great Britain	440	2,860
Sweden	11,880	1,100
France	10,560	440
Austria-Hungary	0	440
Total	25,300	6,380

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To Raise Fire Insurance Rates

NEW YORK, Dec. 5—Automobile fire insurance rates will advance about 10 per cent Jan. 1. The new schedule has been issued by the Eastern and New England Automobile Underwriters' Conferences. In addition to this slight advance, policies will now be written under the non-valued plan, either with or without the theft clause. Heretofore this has not been possible. Policies under the valued plan will include the theft clause as usual. No car can be insured for more than its cost to the owner.

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Wants U. S. A. Ideas

LONDON, ENGLAND, Nov. 15—At the last meeting of the Institution of Automobile Engineers, Mr. A. E. Berriman of the Daimler Co., made the suggestion that endeavors should be made to obtain each session a paper from a leading American automobile engineer, giving the latest views on designs, etc., in the United States. This was in discussion following the reading of a paper on American lighting, starting and ignition systems.

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Cadillac Co. Starts Suit

DETROIT, Dec. 1—The Cadillac Motor Car Co. has started suit against the Cadillac Auto Truck Co., Cadillac, Mich., asking for an injunction restraining the latter firm from using the name Cadillac or Cadillac Auto Truck Co. or any other name prejudicial to the interests of the Detroit concern.

Electro-Pneumatic Gearshift

New Company To Erect Plant in Pittsburgh for Its Manufacture

PITTSBURGH, Dec. 4—The Electro-Pneumatic Gearshift Corp., of this city, has announced its intention to erect a plant for the manufacture of an electro-pneumatic gearshift. The actual power for shifting the gears is supplied by compressed air and contained in a reservoir and fed by a pump driven off the timing gears, there being an automatic valve for cutting in the pump when pressure falls below a predetermined amount. The air is used also for operating the clutch so that all the driver has to do is to move the switch lever mounted on the steering column.

It is stated that the magnetic operation of the valves controlling the air is such that the gears and clutch can be operated at any speed desired. This should eliminate the shock which would be bound to occur if the clutch were engaged automatically always at the same speed. It allows for smooth starting and it also enables the driver to differentiate between a change up and a change down on the gears, operations which should not be performed with quite the same celerity.

The inventor is John J. MacPherson and the company has been formed with M. F. Metcalf president and Joseph C. Baird, secretary and treasurer.

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$10,000 for Fuel Research

NEW YORK, Dec. 1—A $10,000 prize for fuel research will be given by the Aero Club. By the will of the late S. H. Valentine, formerly Governor of the Aero Club of America, this sum has been given to the club to establish a prize, or prizes, for the encouragement of aircraft, which shall not use gasoline as a fuel. Mr. Valentine's bequest is expected to stimulate interest in the discovery of a new fuel, lighter than gasoline, which will make longer flights possible.

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Richardson Chalmers Advertising Mgr.

DETROIT, Dec. 6—C. S. Richardson has been appointed advertising manager of the Chalmers Motor Co., this city. He was formerly with the Mahin Advertising Agency.

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Travers Nash Advertising Mgr.

DETROIT, Dec. 6—E. J. Travers has become advertising manager of the Nash Motor Co., Kenosha, Wis. He was formerly with the Chicago *Herald*.

Winton Chauffeurs Get Prizes

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25 Drivers Total 290,426.7 Miles at Repair Cost of $5.90

CLEVELAND, Dec. 6—The Winton Co., this city, has awarded chauffeurs $3,500 in prizes in its annual contest for those who drive Winton cars the farthest with the least repair expense. This year twenty-five chauffeurs drove their cars a total of 290,426.7 miles at a total repair expense of $5.90. George Felt of Minneapolis, chauffeur for H. D. McCord, won first prize, $500. W. C. Ball of Kalamazoo, chauffeur for F. F. Rowe, was awarded second money, $400. Alfred Shibley of Pittsburgh, driving for J. W. Lloyd, and W. M. Newsome of Atlanta, driving for M. R. Hirsch, won third and fourth prizes, respectively, $300 and $200. Prizes of $100 were awarded to the following:

A. H. Klein, chauffeur; S. J. Wilkins, Chicago, owner of car.
Ralph H. Lee, chauffeur; S. J. Franklin, Millville, N. J., owner of car.
G. M. Lewis, chauffeur; E. R. Caldwell, owner of car.
Henry Belanger, chauffeur; Mrs. D. B. Curtis, Manchester, N. H., owner of car.
George T. Macone, chauffeur; F. E. Coursen, Stockbridge, Mass., owner of car.
Thomas Murren, chauffeur; J. M. Anderson, Boston, owner of car.
Joseph Castellucci, chauffeur; Mrs. M. E. Bearse, West Medford, Mass., owner of car.
Edw. M. Armstrong, chauffeur; C. M. Godnow, Boston, owner of car.
Robert Clements, chauffeur; F. H. Jones, Andover, Mass., owner of car.
P. O. Hale, chauffeur; A. P. Friend, West Newton, Mass., owner of car.
F. H. Coyston, chauffeur; W. L. Porter, Pittsburgh, owner of car.
T. L. Quigley, chauffeur; J. J. Flanagan, Elmira, N. Y., owner of car.
Herbert Lewis, chauffeur; George Spottiswoode, Orange, N. J., owner of car.
Chris McDermott, chauffeur; Robert Fraser, Utica, N. Y., owner of car.
P. J. Farrington, chauffeur; M. H. Hellman, Los Angeles, owner of car.
Charles Schmidt, chauffeur; Thomas Lonergan, St. Louis, owner of car.
W. Desillier, chauffeur; Allen Arnold, Swampscott, Mass., owner of car.
W. L. Woods, chauffeur; Miss H. J. Silver, Brooklyn, owner of car.
A. P. Holst, chauffeur; Mrs. John Sexton, Chicago, owner of car.
E. P. Carey, chauffeur; William de la Barre, Minneapolis, owner of car.
Albert Hitchen, chauffeur; C. W. Tabor, Los Angeles, owner of car.

More interesting than the report for any single year are the grand totals for the entire period during which contests have been conducted—9 years, as follows:

Number of cars that traveled 5000 miles or more each	536
Total mileage made by these cars	5,509,049.3
Average miles per car	10,278
Total repair expenses for all cars	$5,640.64
Average repair expense per car	$10.52
Average repair expenses per car per 1000 miles	$1.03

Or less than 1-9th of 1 cent per mile.

The total distance traveled by these Winton Six cars, every mile of which was sworn to by both the car owner and his chauffeur, is greater than would be traveled on 220 tours around the earth at the equator. Five and one-half million miles certainly constitute an exhaustive test of the standing-up qualities of a motor car. And the average repair expense indicates that a Winton six owner traveling 25,000 miles per year would encounter repair expenses of $25.75 per annum.

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Detroit-Wyandotte Sells Stock

DETROIT, Dec. 1—The Detroit-Wyandotte Motor Truck Co. is selling its unissued treasury stock for the purpose of securing a larger working capital. The concern is going into foreign markets and is making shipments to Porto Rico and Cuba.

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Steel Prices Higher

NEW YORK, Dec. 5—This week's market activities were featured by the expected rise in steel. Both Bessemer and open-hearth rose $2.50 a ton to $55. Lead rose 45 cents per 100 lb. to $7.75. Kansas crude petroleum went up 10 cents a barrel on Thursday to $1. Rubber prices are higher, Para quoting at 79 cents a pound and Ceylon at 74½ cents.

The further rise of rubber will probably hasten the long-expected rise in tire prices, which, it has been reported, will probably go up in the early part of 1917.

Tin dropped to $45 per 100 lb., a net loss of 25 cents. Rapeseed oil rose 3 cents to 98 cents a gallon. Linseed oil dropped 3 cents a gallon to 93 cents.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.14	.14	.14	.14	.14	.14	...
Beams and Channels, 100 lb.	3.17	3.17	3.17	3.17	3.17	3.17	...
Bessemer Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Copper, Elec., lb.	.35	.35	.35	.35	.35	.35	...
Copper, Lake, lb.	.35	.35	.35	.35	.35	.35	...
Cottonseed Oil, bbl.	12.77	12.75	12.71	12.75	12.73	12.70	— .07
Fish Oil, Menhaden, Brown, gal.	.68	.68	.68	.68	.68	.68	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.30	1.30	1.30	1.30	...
Lead, 100 lb.	7.30	7.40	7.40	7.50	7.50	7.75	+ .45
Linseed Oil, gal.	.96	.96	.96	.96	.93	.93	— .03
Open-Hearth Steel, ton	52.50	52.50	52.50	55.00	55.00	55.00	+2.50
Petroleum, bbl., Kans., crude	.90	.90	1.00	1.00	1.00	1.00	+ .10
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.98	.98	.98	.98	+ .03
Rubber, Fine Up-River, Para, lb.	.78	.78	.78	.78	.78	.79	+ .01
Rubber, Ceylon, First Latex	.72	.72	.72½	.72½	.72½	.74¼	+ .02½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	45.25	45.25	45.00	45.25	45.25	45.00	— .25
Tire Scrap, lb.	.06¼	.06¼	.06¼	.06¼	.06¼	.06¼	...

1% Extra Chandler Dividend

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Earnings for Year Estimated at $1,715,000 or $24.50 Per Share

CLEVELAND, Dec. 5.—The Chandler Motor Car Co. has declared an extra dividend of 1 per cent in addition to the regular 2 per cent quarterly distribution, both being payable Jan. 2 to holders of record Dec. 18.

The company is earning approximately $24.50 per share this year, or around $1,715,000. Shipments of cars for 1916 are 115 per cent greater than in 1915, and orders now actually signed up amount to 20,381 cars.

It has been officially estimated that in 1917 net earnings should exceed $2,800,000, which would be equal to $40 per share. The net earnings this year, $1,715,000, allow a surplus of over $1,000,000, after the payment of the 10 per cent dividends which have been declared since Jan. 1.

Chandler shipments in October were four and a half times larger than a year ago; four times greater in November, and will be six times greater in December.

An important factor of the Chandler situation is that its dealers are without cars and are urging deliveries.

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Dividends Declared

Kelly-Springfield Tire Co., quarterly of 1½ per cent on 6 per cent preferred, payable Jan. 2, to stock of record of Dec. 16.

Edmunds & Jones Corp., $1 a share on the common and the regular quarterly dividend on the 7 per cent preferred, both payable on Jan. 2. This is the third dividend the corporation has declared since March 30, 1916.

—

New Directors Proposed for Pierce-Arrow

BUFFALO, Dec. 5.—The transfer of the Pierce-Arrow property from the present company to the Pierce-Arrow Motor Car Corp. will be made to-morrow, when the new organization takes hold, under the presidency of Colonel Charles Clifton.

It is proposed to make the following persons directors of the new organizations: Charles Clifton, president; Henry May, vice-president; W. J. Foss, Buffalo; J. F. Alvord, president of the Torrington Co.; W. S. Cox, of J. & W. Seligman & Co.; C. J. Schmidlapp, vice-president of the Chase National Bank; J. G. Dudley, of Buffalo; Albert Strauss, of J. & W. Seligman & Co., and C. H.

McCullough, vice-president and general manager of the Lackawanna Steel Co., Buffalo.

The company was recently chartered in this State under the name of the Pierce-Arrow Motor Car & Truck Co., with 350,000 shares of capital stock, 100,000 shares of preferred, par $100, and 250,000 shares of common with no par value. The incorporators were L. D. Adkins, R. J. Trimble and E. S. Hemphill.

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Crow Likes Old Name Best

ELKHART, IND., Dec. 4—The Crow Motor Co., this city has changed its name to the Crow-Elkhart Motor Co. The company announced only a few weeks ago that its name had been changed from the Crow-Elkhart Motor Co. to the Crow Motor Co., and now the old name is effective again.

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Ford Tractor Capital Now $10,000,000

DOVER, DEL., Dec. 1—The Ford Tractor Co., Ltd., has filed a certificate changing its name to the Ford Tractor Co., Inc., and increasing the capital stock from $1,000,000 to $10,000,000. The company was first incorporated here Nov. 8, 1916.

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Porter Rubber Doubles Capital

SALEM, OHIO, Dec. 1—The Porter Rubber Co. will increase its capital from $125,000 to $250,000, to permit expansion and the probable construction of another plant.

Motor Issues Are Lower

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General Motors Only One to Show Strength with a Gain of 140 Points

NEW YORK, Dec. 6—The automobile and accessory securities are at present in an apathetic market with a corresponding decrease in value. General Motors, with a gain of 140 points, was the only security to show strength. Last week, this stock declined 90 points on a fluctuating market. Fisk first preferred regained the 9 points lost the previous week by jumping 10 points to 110. Packard preferred gained 3 points.

Chevrolet declined 7 points more this week, making a total of 11 in two weeks. Firestone common dropped 6 points. Studebaker common went down 4 points more to 120 and Willys-Overland common 2⅛ points to 36⅜.

Quotations on the Detroit Stock Exchange were a little higher this week with gains ranging from a fraction to 4½ points. Studebaker common dropped 6½ points in sympathy with the New York quotation. It is reported in Detroit that United Motors stock will soon be listed on the New York Exchange.

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Control Three Tire Companies

COSHOCTON, OHIO, Dec. 5.—The interests who took over the plant of the McClurg Rubber Co. at Coshocton, Ohio, have organized a number of corporations, among which are the Midland Tire & Rubber Co., the Ben Hur Tire & Rubber Co. and the Peerless Tire & Rubber Co. The plant, which is now in operation, will be conducted by the Midland Tire & Rubber Co. The other corporations were chartered in order to preserve the names of the Peerless and Ben Hur tires, which were formerly manufactured at the local plant.

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Pennsylvania Crude Reaches $2.75

NEW YORK, Dec. 6—Pennsylvania crude oil was advanced 15 cents yesterday, making $2.75 a barrel paid producers, the highest price ever reached in the history of the oil industry. A year ago when oil prices went beyond the expectations of producers the price was $2.50 and $3 oil was predicted.

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Milwaukee Gasoline Up 1½ Cents

MILWAUKEE, Dec. 2.—Gasoline prices on the so-called 65-deg. test were advanced 1½ cents per gallon, and on the 70-deg. test 2 cents per gallon, by all oil companies operating in Milwaukee, on Dec. 1. The prices on the lower tests are undisturbed from the last change, effective Oct. 11.

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Parker Rust-Proof Issues Stock

DETROIT, Dec. 4—The Parker Rust-Proof Co. has authorized a capital stock issue of $600,000 7 per cent cumulative preferred stock—non-assessable, and $1,700,000 common stock—non-assessable. The present price of the stock is $100.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	72	..
J. I. Case T. M. Co. pfd.	87	90	..
Chalmers Motor Co. com.	135	..	+1
Chalmers Motor Co. pfd.	110	115	—1
*Chandler Motor Car Co.	111	112	+1
Chevrolet Motor Co.	165	175	—7
Fisher Body Corp.	38	41	..
Fisk Rubber Co. com.	80	90	..
Fisk Rubber Co. 1st pfd.	110	115	+10
Fisk Rubber Co. 2d pfd.	90	100	..
Firestone Tire & Rubber Co. com.	162	165	—6
Firestone Tire & Rubber Co. pfd.	106	108	..
*General Motors Co. com.	650	825	+140
*General Motors Co. pfd.	120	121	..
*B. F. Goodrich Co. com.	69⅜	69½	— ⅞
*B. F. Goodrich Co. pfd.	111	113	—2½
Goodyear Tire & Rubber Co. com.	293	296	—1
Goodyear Tire & Rubber Co. pfd.	108¾	109½	+ ¼
Grant Motor Car Corp.	8	9	..
Hupp Motor Car Corp. com.	3¾	4¼	— ¼
Hupp Motor Car Corp. pfd.	80	95	..
International Motor Co. com.	48	..	—1
International Motor Co. pfd.	23	..	..
*Kelly-Springfield Tire Co. com.	75	76	—1¼
*Kelly-Springfield Tire Co. 1st pfd.	95	99	—1
Keystone Tire & Rubber Co.	15½	16½	— ½
*Lee Rubber & Tire Corp.	37	37½	—1¼
*Maxwell Motor Co. com.	73½	74	— ½
*Maxwell Motor Co. 1st pfd.	81½	82	— ¼
*Maxwell Motor Co. 2d pfd.	49	51	— ½
Miller Rubber Co. com.	255	260	..
Miller Rubber Co. pfd.	108	109	+1
National Auto Corp.	36	37	..
Packard Motor Car Co. com.	168	173	—5
Packard Motor Car Co. pfd.	104	106	+3
Paige-Detroit Motor Car Co.	39	40	+1
Peerless Truck & Motor Corp.	22	24	+1
Portage Rubber Co.	167	169	+2
Regal Motor Car Co. pfd.	20	30	—5
Reo Motor Car Co.	46	48	+ ½
Saxon Motor Car Corp.	76	78	—2
A. O. Smith Corp. pfd.	96¼	97	— ½
Springfield Body Corp. com.	85	95	—5
Springfield Body Corp. pfd.	120	130	..
Smith Motor Truck Co.	6¼	6⅜	+ ⅛
Standard Motor Construction Co.	6	7	—1
Stewart-Warner Speed. Corp. com.	104	106	—2
Stewart-Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	120	120½	—4
*Studebaker Corp. pfd.	109¼	112	..
Stutz Motor	63	64	—2
Swinehart Tire & Rubber Co.	..	88	..
United Motors Corp.	60½	60¾	—1
*U. S. Rubber Co. com.	65¾	66	..
*U. S. Rubber Co. pfd.	113¾	115	+1½
White Motor Co.	53¾	54	— ¼
*Willys-Overland Co. com.	36¾	36½	—2⅛
*Willys-Overland Co. pfd.	98¾	99⅞	+⅝

*At close Dec. 4, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	45½	..	+ ½
Chalmers Motor Co. com.	..	150	..
Chalmers Motor Co. pfd.	112	115	..
Continental Motor Co. com.	43¼	44½	+1¾
Continental Motor Co. pfd.	9¾	10¼	..
Ford Motor Co. of Canada	293	305	..
General Motors Co. com.	..	825	..
General Motors Co. pfd.	119	122	+1
Maxwell Motor Co. com.	71½	74½	—2½
Maxwell Motor Co. 1st pfd.	80	83	..
Maxwell Motor Co. 2d pfd.	48	51	..
Packard Motor Car Co. com.	..	175	..
Packard Motor Car Co.	101	..	—3
Paige-Detroit Motor Car Co.	38¾	39¾	+ ½
W. J. Prudden Co.	53½	56	+4½
Reo Motor Car Co.	46¼	47¾	+1¼
Studebaker Corp. com.	118	122	—6¼
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	29½	31	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	25	33	..

Frontenac Wins at Uniontown

Race Marred by Death of Three in Accident—Winner Averages 102 M.P.H.

UNIONTOWN, PA., Dec. 2—The first race meet on the local speedway to-day was marred by a sad accident in which three were killed. Hughie Hughes, driver of the Hoskins, and Frank Galvin and his mechanician, Gaston Weigel, were killed when Galvin's Premier swerved in front of the pits and side-swiped one-quarter of the press stand, where Hughes was standing. Hughes and Wiegel were instantly killed and Galvin died later. That to-day's race was under the spell of a hoodoo is manifested in the fact that two others were killed a few days before the race when C. M. Heist and F. E. Bush were killed while in practice after they had been ordered off the track. The car struck the wall at the top of the speedway and went through. The accident was due to a crystallized axle.

That the accidents are not the fault of the new 1⅛-mile board speedway makes the death of five appear all the more under the spell of a hoodoo. The track was in good condition and fast.

Hughes in to-day's 112½-mile race was going at 91 m.p.h. when he pulled up on the Pugh car, which was going slowly, and in order to avoid hitting it Hughes ran his car through the guard rail and out into the field in the center of the track. He then went to the pits and was standing beside his car in front of the press stand, when Galvin's car, going nearly 100 m.p.h., suddenly, through some fault of the brake or wheel, swerved into him and the press stand.

Fully 21,000 people saw the races, the main event being won by Louis Chevrolet in a Frontenac, his time being 1:14:12 for 112½ miles, or 102 m.p.h.; Lewis, in a Premier, was second in 1:16:36½; De Palma, in a Mercedes, was third in 1:17:56 1-5, and Newgard, in a Crawford, fourth in 1:25. First prize was $1,000, second $700, third $500 and fourth $400.

The second race, a 54-mile event for dealers, was won by N. P. Fetterman in Peerless in 40:18. M. F. McCarthy in Murray second and H. L. Robinson in Haynes third.

Hughie Hughes, killed to-day, was an English racing driver. He came to the United States 10 years ago, and recently made his home here. Hughes is of the old school of automobile drivers. In 1904, in France, he drove a De Dietrich in the Gordon Bennett race. In 1911 he won the Savannah Trophy race in a Mercer. The same year saw him third in the Grand Prize race in an Ono. He won the Tacoma Potlach contest in 1914, driving a Maxwell. He also won several hillclimbs with the Allen-Kingstons. He took Christie's front-drive car and drove it 110 m.p.h. at Indianapolis. He was a member of the British Aviation Corps and was 31 years old.

Resta Confirmed as Champion

NEW YORK, Dec. 5—The champion automobile racing driver of 1916 is Dario Resta. The contest for points in the American Automobile Assn. championship standing closed with the running of the 150-mile race at the Ascot Speedway, Los Angeles, on Thanksgiving Day. Resta with his total of 4100 points has a lead of 660 points over Aitken, his nearest rival, and he will be officially crowned by Chairman Kennerdell of the A.A.A. Contest Board at a dinner scheduled in Chicago on Feb. 1 under the auspices of the Chicago Automobile Club.

When it was announced last spring that the American Automobile Assn. would officially designate the 1916 champion the Bosch Magneto Co. immediately offered to award a trophy and $2,000 in cash to the driver so selected, and $1,000 and $500 to the drivers ranking second and third in the final official standing. The B. F. Goodrich Co. added $10,000 to the purse thus created, to be split $5,000, $3,000 and $2,000. Resta will thus receive $7,000 and a cup, Aitken $4,000 and Rickenbacher $2,500.

There were fifteen races which figured in the championship standings and the number of points awarded each was governed by the length and character of entries.

The final scores of all drivers with a ranking in the 1916 championship standing follows:

Dario Resta	4100	George Buzane	210
John Aitken	3440	Eddie O'Donell	185
E. V. Rickenbacher	2910	Chas. J. Devlin	140
Ralph De Palma	1790	Arthur H. Klein	125
Earl Cooper	1405	Jack LeCain	120
Wilbur D'Alene	1120	Glover Ruckstell	100
Thomas Milton	690	Barney Oldfield	80
Pete Henderson	667	Earl DeVore	80
Frank Galvin	645	Omar Toft	75
Ralph Mulford	620	Ora Haibe	60
Howard Wilcox	618	George Adams	55
Josef Christiaens	540	Mel Stringer	55
Dave Lewis	500	Jack Gable	45
Ira M. G. Vail	450	Billy Chandler	40
Jules Devigne	350	Bert Watson	35
Hughie Hughes	275	M. Sorenson	35
Clyde Roads	270	Art Johnson	30
A. H. Patterson	270	Jas. A. Benedict	30
Eddie Pullen	260	F. McCarthy	25
Wm. Weightman, 3rd	240	Andy Burt	25
		W. J. Muller	20

Test Fisher Farm Tractors

INDIANAPOLIS, Dec. 6—Five experimental one-wheel farm tractors, of the type to be manufactured by the new company in which Carl G. Fisher is interested, are being tested to destruction with a view to improving the design, which should be completed March 15. It is planned to start production in July.

Stutz Finishes First at Phoenix

Delno, Winner of State Fair Century, Captures 100-Mile Track Race

PHOENIX, ARIZ., Dec. 1—R. H. Delno of Tucson, driving the same sixteen-valve Stutz with which he won the century grind at the State Fair Nov. 18, won the 100-mile Thanksgiving Day race at the State fair grounds yesterday in 1 hr., 38 min. and 29¼ sec. Delno's time was 4½ min. faster than in the State Fair race, which he won in 1:43:12. R. E. Lambert, driving a Spa, was second in the Thanksgiving contest, his time being 1:42:00½. Roy Meacham in a Mercer finished third in 1:46:12.

Mechanician Killed

W. M. Drennan of Oklahoma City, a mechanician, was killed almost instantly when the Hudson entry No. 5 crashed through the fence on the north turn while R. G. Armstrong, driver, was attempting to pass the car ahead. The accident, which occurred in the seventh lap, was caused by Armstrong swinging to the outside of the track in an effort to pass the car ahead, and as both right wheels went over the bank into the soft earth Armstrong and Drennan were hurled from the car. Drennan was thrown against a post, as the big racer crashed through sixty feet of fence. Armstrong's escape with slight injuries was miraculous.

Pete Thomason in a Ford finished fourth in 1:49:26 and Al Gladney's Overland fifth in 1:49:40. The performance of the Ford, which went 94 miles without a stop, was one of the features of the contest. Thomason threw a tire in the ninety-fifth lap, otherwise would have been in the money. Seven of the nine entrants were running at the finish.

A. A. A. Opens New Offices

NEW YORK, Dec. 2—The American Automobile Assn. is establishing a branch bureau in the Circle Building on Broadway near Fifty-ninth Street.

U. S. Cars Popular in Java

NEW YORK, Dec. 2—Of the 759 automobiles imported into Java for the first 6 months of this year, 668 cars came from the United States, fifty-three from Italy and thirty-two from the Netherlands.

Roads Built Under Federal Supervision

WASHINGTON, D. C., Dec. 2—Nearly 5,000,000 sq. yd. of roadway, the equivalent of 561.9 miles of road 15 ft. wide,

were constructed under the supervision of Federal road specialists during the last fiscal year, according to the annual report of the Office of Public Roads and Rural Engineering, of the U. S. Department of Agriculture, just issued. This is more than double the mileage so constructed in previous years. The roads constructed under supervision of the office include experimental roads, post roads, county roads, and roads in National Parks and forests.

—

Boston Show Space Sold

BOSTON, MASS., Dec. 2—Practically all the space for the Boston show which opens in March has been sold. Provisions may be made later to take care of a few late comers, but they will have to share space with someone else, and possibly go in the basement. The first floor will be given over entirely to cars, and the balconies will have the accessories. There will be more space available this year because the big dining room has been taken over for the next show and this will give a big slice of room. A small section of hallway will be used for a luncheon space.

—

75 Auto-Lite Men Convene

TOLEDO, Dec. 4—Seventy-five members of the Electric Auto-Lite Co.'s organization met here in convention to-day.

—

Trumbull S. K. F. Advertising Manager

HARTFORD, Dec. 2—H. N. Trumbull has been appointed Advertising Manager of the S. K. F. Ball Bearing Co., this city.

Rickenbacher Wins at Ascot

—

Duesenberg Takes 150-Mile Race—Cooper Is Second and Pullen Third

LOS ANGELES, Nov. 30—Eddie Rickenbacher in a Duesenberg to-day won the 150-mile Championship Award Sweepstakes race on the 1-mile paved Ascot Speedway, the final event in the American Automobile Association's contest for the title of champion driver of America. His time was 2:18:15.5. Cooper in a Stutz was second, Pullen in a Mercer was third, and Ruckstell in a Mercer was fourth. Cooper ran out of gasoline ½ mile from the finish, but coasted to the tape. Attendance was 30,000.

Pullen led at the 50th mile, with Rickenbacher, Cooper, Ruckstell and the field following. Pullen's time was 42:55 for the 50 miles, an average of 69.9 m.p.h.

Pullen, Rickenbacher, Cooper and Ruckstell were bunched in the lead in that order at 100 miles. Pullen's time was 1:28:18, an average of 57.95 m.p.h.

There were twelve entries and $5,000 in prizes, divided into $3,000 for first, $1,250 for second, $500 for third and $250 for fourth.

—

17 Exhibitors for Salon

NEW YORK, Dec. 2.—There will be seventeen exhibitors at the thirteenth annual Automobile Salon, Jan. 2 to 10, in the grand ball room of the Astor. Though the number of exhibitors is one less than the high mark established in 1912, the number of cars will be about 40 per cent greater, as the balcony of the ball room is to be used for exhibiting the overflow.

The list of exhibitors contains one which has heretofore exhibited at the National Shows, the Locomobile Co. of America. The other exhibitors are: White, Brewster, Daniels, Isotta-Fraschini, Lancia, Murray, Navara, Phianna, Rolls-Royce, Simplex, Singer and S-S-E. Custom body builders include Brewster, Holbrook, Locke and Rubay. In addition to these exhibits there will be a half dozen of tires and accessories.

The exhibition of the Navara marks the debut in the automobile field of the Herreshoffs, of Bristol, Conn., prominent builders of racing yachts.

—

Fritz Leaves Motor Appurtenances

NEW YORK, Dec. 1—George Fritz of Malverne, L. I., has resigned as vice-president and sales manager of the Motor Appurtenances Corp., this city, handling the J & B products, Jiffy jack and Wondertone horns. He will announce his new connection in the near future.

—

Feeley Supt. Pittsburgh Maxwell Branch

DETROIT, Dec. 4—C. R. Feeley has been appointed superintendent of the Pittsburgh service branch of the Maxwell Motor Co.

—

France Heavy Buyer of U. S. A. Cars in October

(*Continued from page* 951)

997. Denmark is another country that did not appear in last year's returns, while in October of this year 342 cars, valued at $241,020, were shipped there. During the 10 months of 1916 the exports amounted to 1305 cars, valued at $955,432.

During the 10 months of last year four cars, valued at $2,800, were shipped to Germany. Since then that country has not figured in the export returns. Italy bought seven cars from this country in October last, the value of which was $7,517, while in October a year ago forty cars, valued at $25,887, were shipped there. During the 10 months' period the shipments increased from 210 cars, valued at $134,901, in 1915, to 244 cars, valued at $151,484, in 1916.

Shipments of cars to other European countries amounted to 301 cars, valued at $327,196, in October last, and to 3403 cars, valued at $4,194,615, during the 10 months of this year. Last year the exports amounted to 814 cars, valued at $1,920,176, in October, and to 7502 cars, valued at $20,003,140, during the 10 months' period.

One thousand and twenty-one cars, valued at $718,962, were shipped into Canada in October last, while in October of last year the number was only 189 and the value $202,552. During the 10 months' period the shipments increased from 5238 cars, valued at $4,154,137, in 1915, to 11,118 cars, valued at $8,025,079, in 1916.

S. A. Shipments Increase

The exports of automobiles to all South American countries in October, 1915, amounted to 383 cars, valued at $210,840, while during the 10 months of last year the exports amounted to 2464 cars, valued at $1,277,326. This year the returns show that 302 cars, valued at $195,512, were exported to Argentina in October, while during the 10 months of this year the exports amounted to 4258 cars, valued at $2,206,709. Shipments to other South American countries were as follows: Brazil, forty-four cars, valued at $33,046, in October, and 348 cars, valued at $232,860, during the 10 months. Chile, 195 cars, valued at $158,719, in October, and 1075 cars, $712,748, during the 10 months. Venezuela, thirty-six cars, valued at $23,781, in October, and 447 cars, valued at $284,316 during the 10 months. All other South American countries 113 cars, valued at $64,986, in October, and 816 cars, valued at $509,877, during the 10 months.

Large gains are noted in the exports to the West Indies and Bermuda, the shipments increasing from 267 cars, valued at $173,355, in October, 1915, to 665 cars, valued at $505,198, in October last, and from 2625 cars, valued at $1,478,360, during the 10 months of last year to 4704 cars, valued at $3,152,389, in 1916.

There was also a large increase in the exports to Australia, Asia and Oceania during the two periods under consideration. Detailed figures appear in the tabulation on page 951.

The Automobile

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Ignition

IT seems rather remarkable that after so many years of development we should not yet have arrived at one, single, standard form of ignition for automobile engines. Yet this is really testimony to the automobile engineer's instinct never to be satisfied with what he has but always to want something better.

When the magneto came it was less reliable than the coil and battery, but for a short time only. Soon it was supreme. Then came the starter and its essential battery, so back once more to battery ignition and a general concentration of brains on the problems appertaining thereto; so that we have now battery ignitions which will do everything the magneto ever did, save only to supply their own motive force.

Ignition units of 1917 are vastly more refined in mechanical detail than they ever were before. The high-speed engine has found the weak spots in many a device, and the general redesign thus called for has led to the use of much better principles combined with better construction. The change has spread over several years, of course, but we have now a far wider choice of igniting mechanisms of high quality and great reliability than we ever had before.

Exactly what happens to the gas in a cylinder as a result of passing a spark through it is still unsettled. There is more than one scientific theory and various of the learned men of the world are still working on the problem. The things we may learn from these researches ultimately is the exact effect of different sorts of spark, different spark intensities, sizes and temperatures. Whether the construction of ignition apparatus will be affected when we do possess this knowledge cannot be said. It would certainly have been a help in the past, but cut and try methods have had such fine results that revolutionary changes are unthinkable.

Legal Confusion

A DECISION in the United States Supreme Court establishing the right of any State to tax non-resident automobile owners for the use of the roads opens up such possibilities of confusion that it throws into the spotlight once more the need for making automobile law a matter for the Federal Government.

Roads are a national asset. Easy transportation in the Far West affects prices in the Far East. Entirely apart from the military importance of roads, modern commerce demands that they be everywhere as good as possible.

The present situation with regard to road building is little short of absurd. The same questions are being debated over and over again by different legislatures. The same experiments in road building are being repeated many times in different States. There is an enormous wastage of energy, a prodigious throwing away of money.

The sums which have got to be spent in America in the next 20 years to provide a country with adequate roads are so great and the possibilities for waste of the present system so potent that common sense demands the centralization of authority as essential. It is the only way to get the work done properly and promptly.

Time was when a man's travels would rarely take him beyond the borders of his State. Then State boundary had a real meaning, which to-day it does not possess for the traveler.

100 M. P. H. on Roads

THE old saying, "a place for everything" is brought strongly to mind by the accident which marked the recent Grand Prize race held over the Santa Monica course. Road races over courses such as this are relics of the early days of the industry when speeds of 60 m.p.h. were something out of the ordinary and accidents were correspondingly less likely to be serious, but to-day when speeds of over 100 m.p.h. are possible on such courses an accident assumes possibilities hitherto inconceivable.

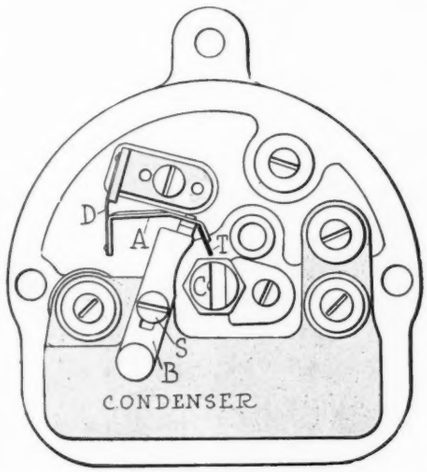
When it is realized that a 3000-lb. car traveling at 100 m.p.h. exerts approximately 2000 hp. at the moment of impact with a stationary body, and that the force of the blow is equivalent to that of a 1-ton weight falling through a distance of 500 ft., the killing of four persons, including the driver of the car, the serious injury of his mechanic and two other people, as well as the destruction of two trees and the car might be accepted as reasonably to be expected.

Ignition Is Much Improved

Battery Systems Are Stronger, More Durable and More Effective—Adjustments Are Easier and Replacement of Wearing Parts Simplified—Few Novelties in Magneto Construction

WITHOUT question the amount of development work done during the year with battery ignition systems has been such that the effectiveness of this form of ignition and its suitability for a permanent place on an automobile can no longer be doubted. The battery-vs.-magneto controversy is still with us, but there is every indication that it will remain in somewhat the same condition as the six versus four argument, and that the final analysis will show both magnetos and battery systems in continued use, each having its own definite sphere.

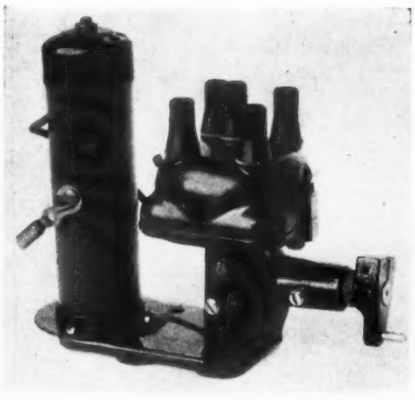
The real secret of a successful ignition device, whatever its principle, is the accuracy of its manufacture. A timing device, breaker or whatever it may be called, has to perform excessively rapid motions in quick succession and with extremely accurate spacing. Irregularity of operation renders the apparatus useless, and accuracy, especially at high speeds, can only be obtained by workmanship of an extremely high order of merit. Materials must be selected with great care and every process in manufacture watched and inspected with rigid adherence to the fine tolerances allowable. This means that it is a very difficult thing to make a good ignition distributer and coil or a good magneto, and it is only good ones that are any use. With greatly increased demand the ignition manufacturers have had to expand while beset with difficulties in getting the right materials and trouble in obtaining the requisite class of labor, but they have risen to the demand wonderfully.



Mechanism of the bearingless breaker of the Atwater Kent closed circuit system

So far as design is concerned, 2 years ago the coming of the high speed engine called for changes, but the ignition breakers operate to-day at much higher speeds than any engine requires; mostly the igniter is in possession of a capacity to ignite at a speed of from 500 to 1000 r.p.m. greater than the engine of any machine on the road.

Two entirely new systems have appeared recently, the Philbrin and the Pittsfield, both being quite different from any of the older varieties. Among the big producers, Atwater Kent has made the most prominent change by adding a closed circuit system, having previously made only an open circuit instrument. Connecticut, the closed circuit system with an automatic throw-out for the switch, should this be left on with the engine stopped, has been altered in detail but not in any principle. Remy, Westinghouse and Bosch, protagonists of the closed circuit, have made practically no changes, and the same is true of the many instruments produced in smaller quantities. A general bettering of mechanical detail is the chief thing noticeable.



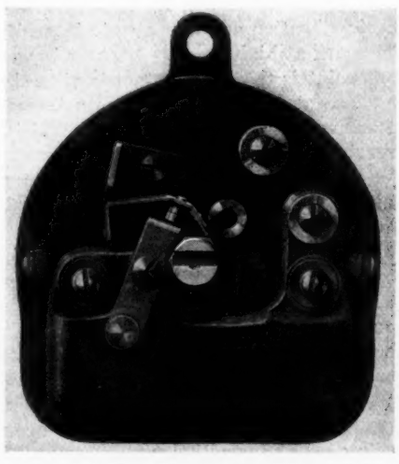
Atwater Kent closed circuit distributor with the coil mounted alongside

Atwater Kent Uses Closed Circuit

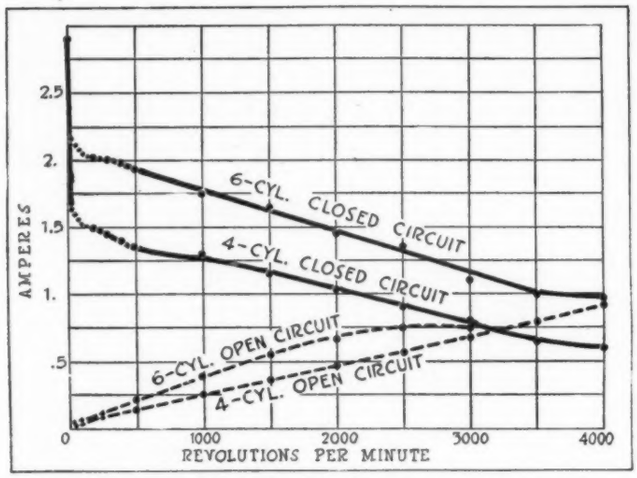
The closed circuit system which Atwater Kent will make in addition to its well known open circuit type is known as the CC and is quite different in construction from any other closed circuit distributer. Externally it is similar in appearance to the older model, and there are the same three units of distributer, coil and switch, but the similarity ends at this point.

It is well known that the Atwater Kent Co. has one of the most up-to-date testing equipments for ignition devices, and it is mainly on the oscillograph and the current measuring instruments that this new ignition has been developed. The curves of current consumption for the closed and open circuit Atwater Kent igniters plotted side by side show that the difference at ordinary running speeds is quite small, and that the greater demand of the closed circuit only appears strongly at very low speeds indeed.

The most striking feature of the device mechanically, is its remarkable compactness and the use of a spring suspension for the breaker blade instead of a pin and socket or bearing of any kind. It would seem that the weight of the only



Six cylinder Atwater Kent type CC breaker mechanism



Comparative current consumption for the two Atwater Kent systems, the closed and open circuit types

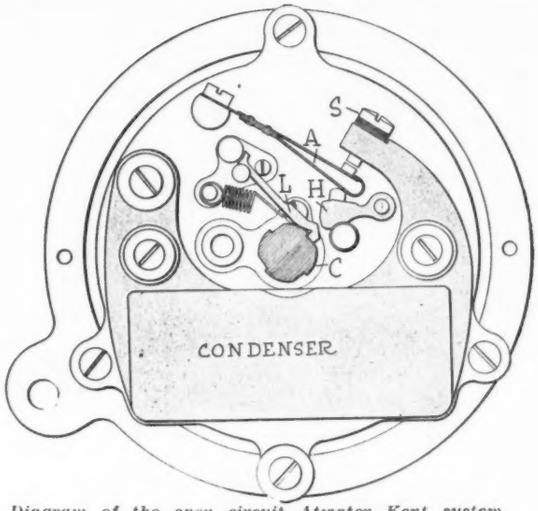


Diagram of the open circuit Atwater Kent system which has not been changed in design

moving part is as small as it could possibly be in any form of instrument, the object, of course, being to get rapid enough action for multi-cylinder engines and to eliminate lag almost completely.

The unit is built up on an iron base which carries the condenser also. The contact arm is a steel stamping tipped with fiber where it touches the cam, and is riveted to a short length of spring steel D which in turn is riveted to the block L. The distributer cover is Bakelite with the terminals molded in place. There is no wiping contact in the distributer, the air gap between the nickel alloy distributer blade and the terminals being 0.015—0.020 in.

The shape of the cam has been determined by the experiments which showed that even the slightest variation in the radius of the curved portions between the flats exerted a powerful influence on the character of the spark. In the four-cylinder cam the limits of tolerance across the corners is 0.002 in. and across the flats it is 0.0015 in.

The light weight of the contact arm is an important factor in the operation of the breaker. In addition to reducing wear to the minimum, it eliminates harmonic vibration and operates to intensify the spark at high speed. Another important point is that the contact is virtually in the center of the contact arm instead of one end, thus reducing inertia and increasing synchronism. Also, because of the location of the arm contact, the two points must come together absolutely squarely with reference to each other.

Revolution of the cam C brings its corners in contact with the fiber tip T of the contact arm A, thus separating the contacts and breaking the circuit. The contacts therefore are together for a considerable period, permitting the coil to be saturated thoroughly. The angular dwell, or the space during which the contacts of the four-cylinder instrument are together, is 47.9 deg. and the contacts open 0.006 in.

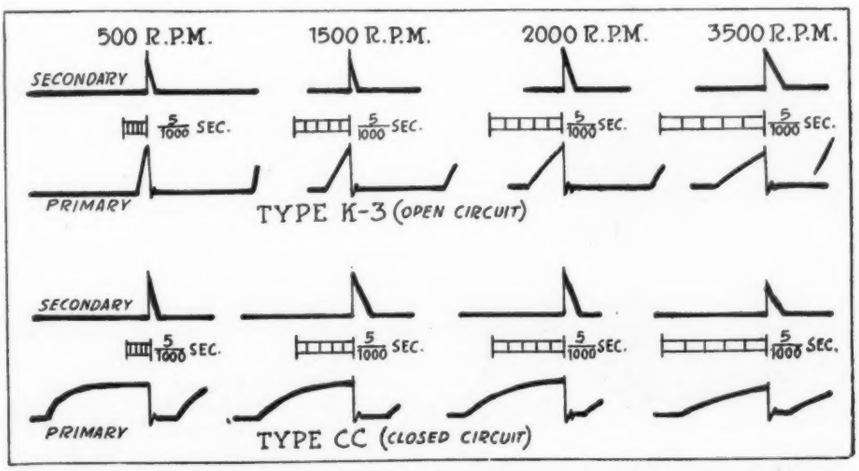
Tungsten is used for the contacts the one in the arm being forced in place, and there is but a single adjustment. To alter the size of the gap between contacts, the screw S is loosened and the arm B moved the required distance, this being slotted where the screw goes through.

Atwater Kent type K3 complete assembly

Owing to its proximity to the contacts the condenser requires to be only about one-sixth the size that would be required were it located in the coil container as has been previous practice. Furthermore the condenser in its new location now is instantly accessible, though cases where it is necessary to touch it are extremely rare.

The coils used for both Atwater Kent systems are practically alike except that the coil for the CC system carries a small series resistance for protection in case of very low speeds and in case the switch should be left closed with the engine stopped. These coils are slightly different from their predecessors as the primary and secondary windings are each continuous, instead of being in two sections each and this has permitted a slight reduction in the size of the unit. At present only hand advance is supplied though the instrument will be made with automatic advance.

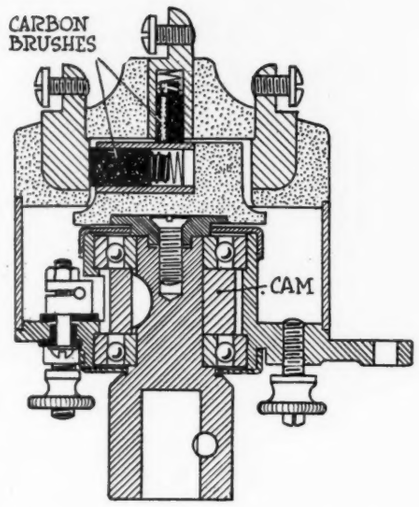
The CC instrument is made in four-,

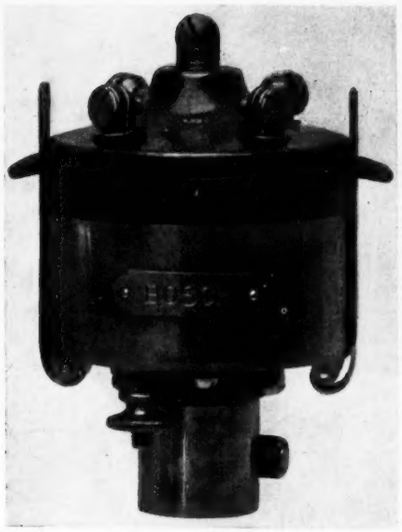


Oscillograms made with the two Atwater Kent systems run under the same conditions

six- and eight-cylinder types and the oscilligrams indicate that character and intensity of the spark up to speeds of 3500 r.p.m. are excellent.

The open circuit, K3 instrument remains unchanged, except that the condenser has been located within the timer-distributer unit and in close proximity to the contacts. This has permitted a reduction in the size of the condenser and, at the same time, increased its effectiveness. In operation, rotation of the cam C draws the lever L forward until the movement of the cam trips the lever which in returning to its original position under the influence of a spring, strikes against the hammer H. The momentum of the hammer H striking the contact arm A instantaneously closes the circuit and opens it again. Here again the only part requiring adjustment is the contact, and even this should not need touching for 10,000 miles. To adjust the contacts the screw S is removed, the face of the contact dressed and one of the thin washers under the screw removed before the screw is returned to position. The standard automatic advance mechanism is provided for the K3 and it is made for four-, six-, eight- and twelve-cylinder engines.

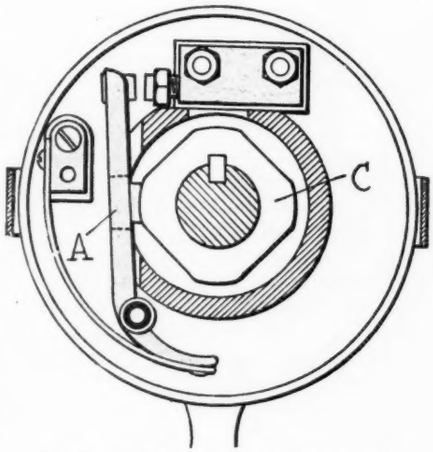




These two views of the Bosch timer-distributor show the very compact nature of the design and how access to the breaker is obtained by removing the distributor head

No Change in Bosch Distributer

The Bosch battery ignition unit is modeled very much upon the magneto breaker and distributer. Rotation of the cam C presses a fiber block which brings the contacts together and a spring separates the contacts at the moment of ignition. Manually operated advance is provided. The distributer is mounted directly over the breaker and consists of the usual cover with the terminals molded in place. A radial arm carries a carbon brush which makes wiping contact with the terminals successively.

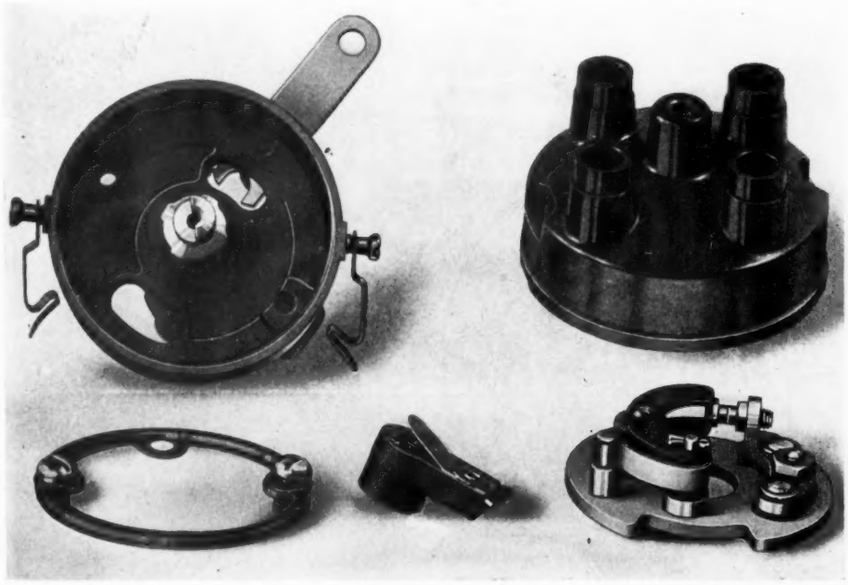


Details of the Bosch battery ignition breaker

The switch incorporates a vibrator attachment to facilitate starting; controlled by a button in the center of the switch plug. Under normal starting conditions momentary pressure on the button will produce a single spark at the plug. Turning the plug to the right and depressing it makes the necessary connection to provide a continuous stream of sparks at the plug and the button can be locked in this position until the engine has started.

There is only one adjustment, for the gap at the contacts. With the fiber block resting on the top of the cam the contacts should be separated about 0.01 in.

This Bosch battery system has been on the market a very long time, having been produced at a period when starting on the magneto was not as easy as it is now.

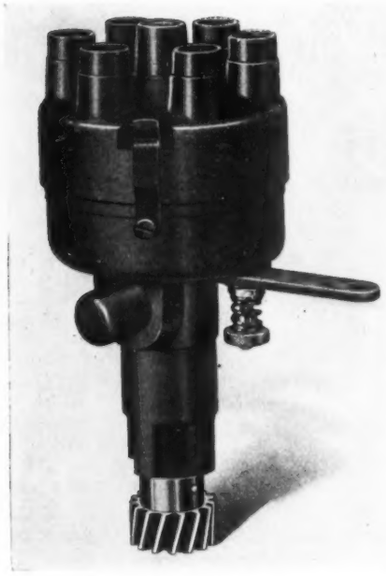


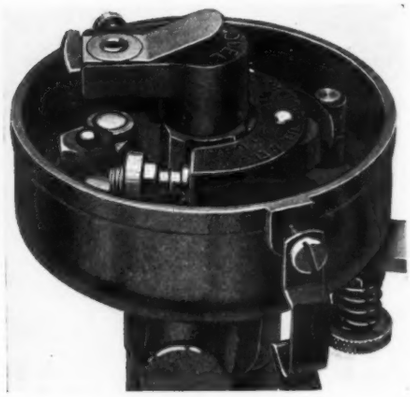
Connecticut breaker mechanism is mounted on a plate held by a spring ring under a solid ring. Removing two screws permits the breaker to be withdrawn complete

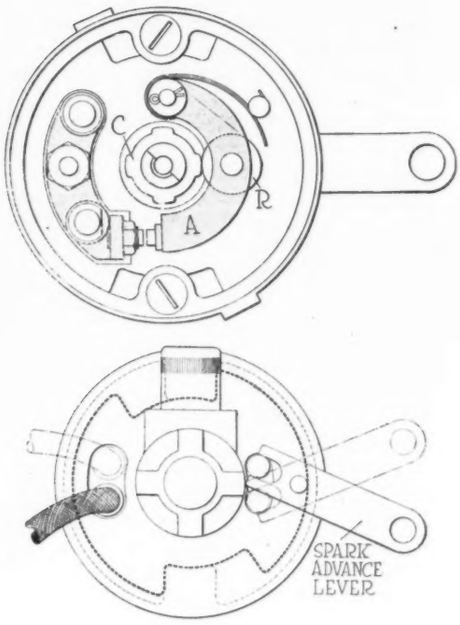
Connecticut Accessibility Improved

The closed circuit Connecticut instrument has not been changed in principle, the main alteration being in the advancing mechanism, which now is entirely internal and alters the relative positions of cam and breaker arm without moving the distributer or any of the wiring. The whole breaker as a complete unit can now be taken off for cleaning or adjustment more readily than before, as it is now retained by only two screws.

The new advancing device is particularly ingenious. The breaker is set upon a plate which can turn within the stationary outer case. In the bottom of the case is a small slot and through this a pin screwed into the breaker plate projects. On the bottom of the casing and outside of it, close to the slot, is a pin which forms the fulcrum for a short lever. The inner end of this lever is slotted and embraces the pin which comes







Left—The Connecticut complete assembly. Center—Removing the distributer head lays bare the breaker. Right—Diagrams of Connecticut breaker and of new advancing mechanism

through from the breaker plate, and the outer end of the lever is linked to the advancing rod.

The breaker carrying plate is held in place by a spring ring and a solid ring, the latter being held by the two screws mentioned.

The detail of the breaker mechanism remains unchanged. In operation, rotation of the cam C touches the fiber roller R in the arm A, thus separating the contacts and the arm is returned to its normal position by a spring.

The feature of the Connecticut system which eliminates the possibility of the battery being exhausted through the switch being left closed with the engine stopped is retained without change. This is effected by the use of a miniature thermostat which is in series in the primary circuit and which controls a mechanism similar to that in an electric door bell. If the engine is stopped with switch closed the primary current, in passing through the thermostat, heats it, thereby bending it and closing a circuit through the buzzer mechanism and this in turn automatically opens the switch. The action of the thermostat can be set for anything from 30 sec. to 4 min., the normal setting being about ¾ min.

There is a new type of high-tension lead connector using a brass ferrule. The wiring is stripped for about ¼ in. and the ferrule is slipped over and screwed into the insulation. Afterward a narrow portion of the ferrule is depressed, thereby locking it securely in place. The wiring fits snugly into tapered holes in the distributer cover, the assembly being completely waterproof.

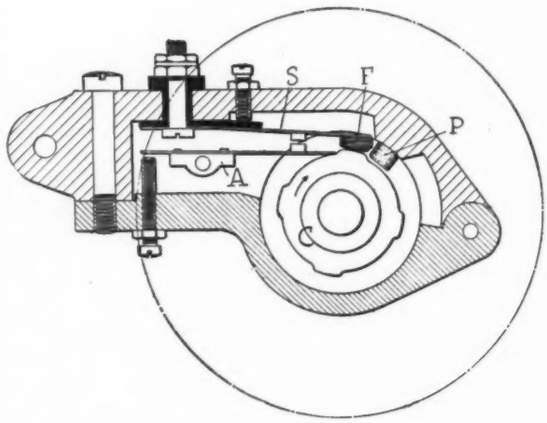
Another new feature is a simplification of the wiring to the coil, this now being so arranged, through the use of a hexagonal terminal, that it is impossible to put a wire on the wrong connection.

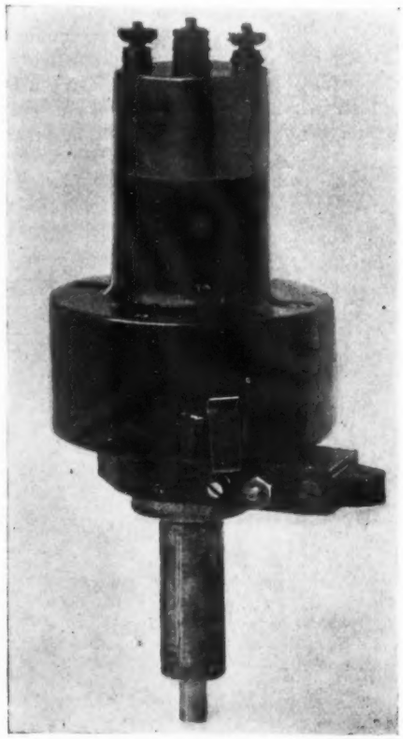
Philbrin Entirely New

Described fully in THE AUTOMOBILE for Oct. 5, the Philbrin ignition is an entirely new dual system. Primarily it is a single spark ignition of the open circuit type, having a novel breaker mechanism. In addition there is, combined with the switch, a small vibrator which, when in use, sends a continuous stream of sparks to the distributer, providing a very effective ignition for a cold or poor gas. Either the single spark or the other ignition can be obtained by merely turning the switch.

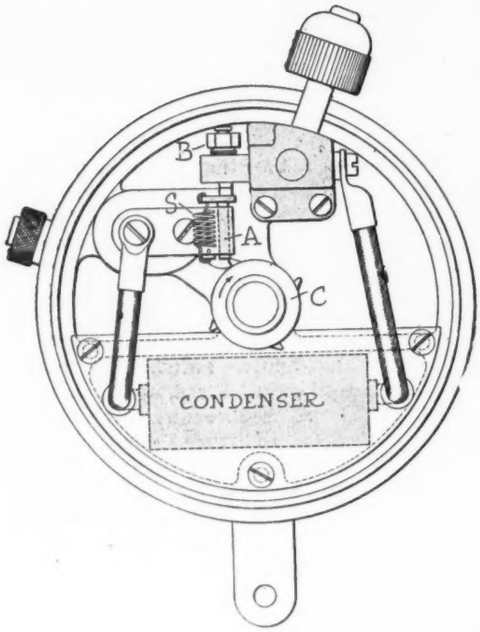
In the breaker there is what may best be called a plunger, carrying the contact at the outer end. The cam has a series of sharply pointed projections which hit the lower end of the plunger and lift it up against the fixed contact, the latter being backed by a small stiff spring. The contact remains closed long enough to saturate the coil, and the plunger is pulled back sharply as the cam passes on, by a coil spring. If the cam turns backwards the plunger gives way before it, being held in place by spring pressure, so the contacts do not close except when the cam is turning the right way. This breaker takes no part in the continuous spark, auxiliary system which sends its high-tension discharge to the distributer direct.

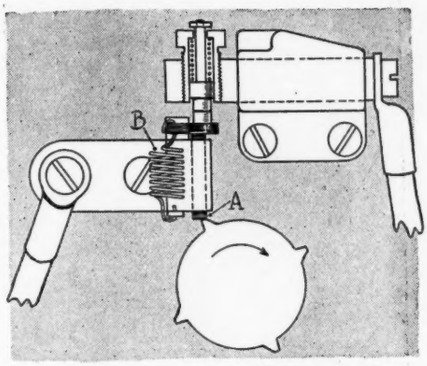
The distributer has a long arm with a blade of peculiar form which does not

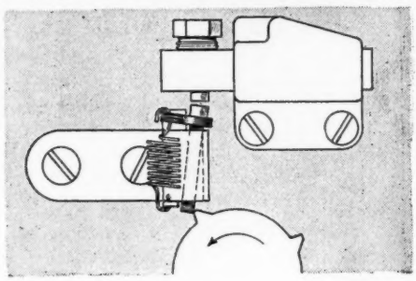




Pittsfield ignition unit. The cam C first lifts blade A so closing the contacts, and then raises the fiber block F so lifting blade S and positively separating the contacts again. P is a wick for supplying oil to the cam





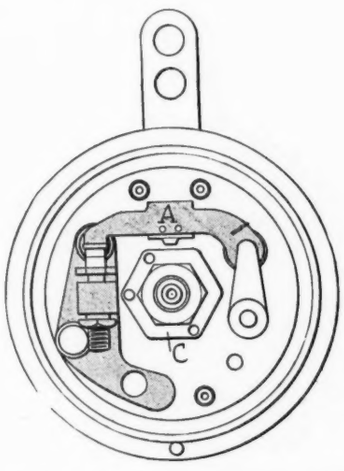


The Philbrin instrument and diagrams showing details of the breaker. The lower right hand view shows what happens when the cam revolves backwards, in which case the contacts are not brought together

touch the terminals molded into the Bakelite cover. It passes in very close proximity to the terminals and the spark passes a small air gap. The reason for the long blade is to insure a continuous stream of sparks at the plug during a considerable part of the piston travel. The current consumption under this continuous spark operation is about 1 amp.

The Philbrin switch also provides for two sources of current—the usual storage battery and an auxiliary set of dry cells. The arm is moved in one direction for the storage battery and the other way for the dry cells. The lever which controls the operation of the single spark or the continuous spark ignitions is a small, continuously rotatable plug. It is alternately marked M and S, designating whether the main or secondary systems are in operation. This switch also reverses the polarity of the current each time it is turned thus conserving the life of the contacts. The coil is contained in a metal case and is completely waterproof. It may be mounted on the dash and in some installations is mounted directly with the distributer mechanism. Two condensers are used, one for each system, and these are quite separate and both are amply protected.

There is but a single adjustment on the system this controlling the opening of the contacts on the main or single spark system. Naturally, improper running of the engine will suggest the advisability of dressing the contacts to smooth surfaces. The adjustment is plainly visible and the gap between the contacts should be 0.025—0.030 in. No adjustment is provided for the vibrator of the secondary, or continuous spark system, the manufacturers stating that it should never be touched.



Latest type of Remy ignition unit and diagram of the breaker. The arm A is a light steel stamping

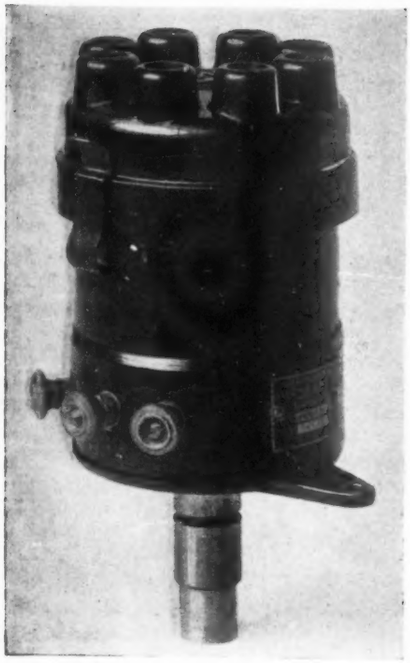
Pittsfield Has Positive Action

The Pittsfield open circuit system is unique in having the contacts both closed and separated by cam action, the timing not depending on a spring action. The contacts are mounted on two blades of stout spring steel, one having a steel and resting on the cam and the other a fiber block. Normally, with both spring blade ends on the flat part of the cam the contacts are held apart; then as the cam comes round, the shorter blade is lifted till the contacts close. Further movement causes the peak of the cam to pick up the fiber block on the longer blade, and this separates the contacts again. Since both these actions are mechanically performed by the cam there can be no lag due to hesitancy in spring action.

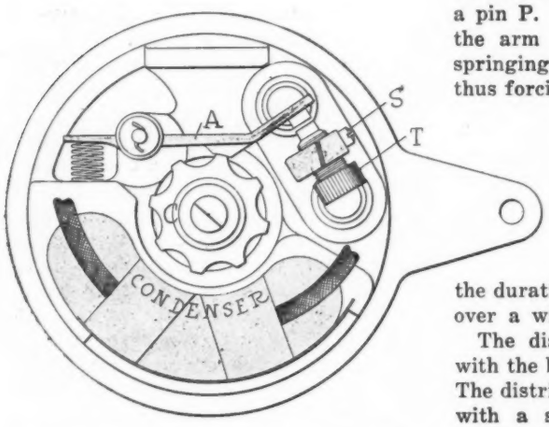
The contacts are permitted to remain together for the maximum length of time, thus assisting in the proper saturation of the primary winding of the coil.

The distributer and coil are in unit with the breaker and the cover is the usual Bakelite casing with the terminals molded in. The distributer arm does not touch the terminals, the spark jumping a small air gap. The coil is completely inclosed and is on top of the cover of which it forms a part.

It is exceptionally easy to disassemble the whole unit. The breaker mechanism is assembled in a sort of handcuff device which is simply clamped around the shaft. Removal of one screw permits the whole to be taken off for inspection. The only adjustment is for the opening of the contacts and this is easily accessible from outside the casing. Removal of the distributer cover and coil exposes the distributer mechanism and after the key



Above — Westinghouse unit comprising breaker, distributer and coil in one assembly. Below—Diagram of Westinghouse breaker. T is the point adjustment and S the locking screw



holding the camshaft has been withdrawn the whole shaft can be lifted out.

Remy Has Stationary Distributer

The breaker mechanism of the Remy battery ignition unit is very simple, and of magneto type, the cam bearing upon a fiber insert in the breaker arm. The circuit is normally closed and is broken only at the instant of ignition. In the sketch the fiber contact piece resting on the cam is designated by the letter F and it may be mentioned that the fiber is securely riveted to the breaker blade.

All the breaker parts are mounted on a plate which is rotatable within the fixed distributer head, the advancing lever coming out through the casing; there is no provision made for automatic advance.

The distributer mechanism has not been altered and consists of the usual Bakelite cover with the terminals molded in place. There is no wiping contact, the spark jumping from the radial distributer arm to the terminals.

The Remy coil has been altered slightly in the past year. The principle is the same, though certain refinements in the method of binding the high tension end of the winding have been made. On top of the coil there is a miniature resistance coil in series with the primary winding which protects this winding should the engine remain idle for any length of time with the switch closed. In short, it protects the winding and also prevents excessive drain on the battery.

Under ordinary conditions the contact points, which are iridium-platinum or tungsten, should not require attention more than twice a season. They should be adjusted so that the maximum opening is 0.020 to 0.025 in., or the thickness of the gage piece riveted to the wrench.

Rhoades Is Simplified

Sundry mechanical changes affecting the simplicity of the Rhoades open circuit igniter have been made during the year, but there has been no alteration in principle. In the sketch showing the latest type the cam C is loosely mounted on the shaft and rotated by contact with a pin P. As the cam rotates it presses the arm A outward and this arm, in springing back, hits against the lever L, thus forcing the contacts together for an instant. If the cam is rotated in the reverse direction it simply rides over the pin and does not bring the contacts together. The contacts are closed only by the momentum of the arm A so the duration of contact remains the same over a wide range of engine speed.

The distributer cover is conventional with the brass terminals molded in place. The distributer arm is keyed to the shaft with a set screw and cannot be improperly assembled, and the arm does not make contact with the terminals, the spark jumping a small air gap.

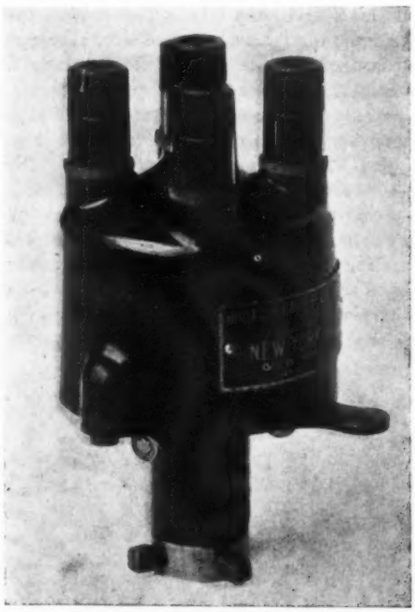
Westinghouse in One Unit

For its battery ignition the Westinghouse company uses the closed circuit principle, the breaker being about as simple as possible. It consists of a stamped steel arm with a contact at one end, and a fiber block about midway of its length, against which the cam strikes. At the other end of the arm there is a coil spring in compression, which keeps the contact points pressed together.

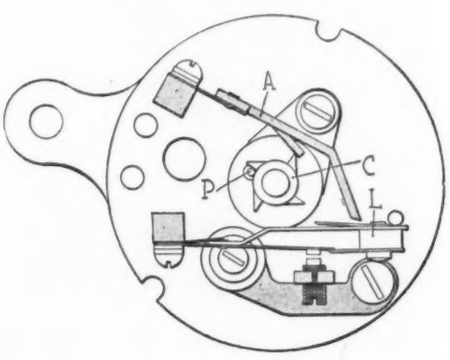
The whole unit is extremely compact, the condenser being mounted on the plate which carries the breaker, while the coil is contained in a chamber above the breaker, the distributer being at the top, above the coil. This means that the only external connection besides the high tension leads is the wire going to the switch.

The distributer arm, which is easily detachable, carries a double-ended carbon brush, the lower end thereof bearing on a ring of copper, and the upper making contact with the successive cylinder terminals. An opening in the casing can be uncovered for the purpose of trimming and adjusting contacts, while access to the distributer is obtained in the usual way. In adjusting the breaker the contacts should be dressed with a fine file and adjusted so that the maximum opening is 0.008 in.

The switch is combined in one mounting with the lighting switches, for attachment to the cowl board, and it is so constructed that the direction of the current is reversed each time the switch is turned. In the back of the switch plate there is what is termed a ballast coil. This is a small resistance in series with the final winding and is to protect the winding and prevent excessive drain on the battery should the motor remain idle with the switch in the "on" position. If this should be accidentally broken the ballast terminals may be temporarily short-circuited.



Rhodes open circuit timer-distributer with diagram of breaker below



Few Changes in Magnetos

Small Mechanical Details Refined But No Radical Alterations Made — Some New Models

PRACTICALLY the only changes which have taken place in magneto construction during the past year concern petty mechanical details. During 1915, when engine speeds were rising rapidly, several of the magneto makers modified their instruments to take care of the new condition. The work they did at that time, however, has proved so effective that there is no need for any further changes at the present time.

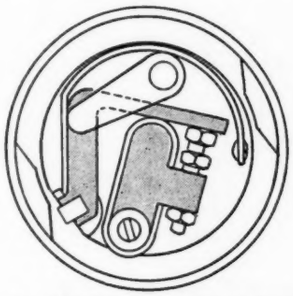
The condition affecting magneto manufacture which has changed for the better is the production of magnet steel in America. The bulk of this steel used to be imported and, when imports were cut off, most of the magneto makers had some trouble to discover a sufficiently reliable source of supply in this country. The steel makers, however, have done their best, with the result that satisfactory American magnet steel is now obtainable.

Whatever may be the ultimate outcome of the battery-vs.-magneto argument applied to passenger cars, it should not be imagined that the present predominance of battery systems in this field has caused a reduction in magneto outputs. The truck industry is using magneto ignition almost exclusively and cutting off the German supply has created a big export business, England and France both taking quantities of machines.

The immediate problem before the ignition industry in general, and the magneto part of it in particular, is the production of a satisfactory ignition device for aviation engines. The uninitiated would not anticipate any special difficulty in this connection. It would seem that a magneto that would operate for years in an automobile ought to be equally perfect for an aeroplane engine.

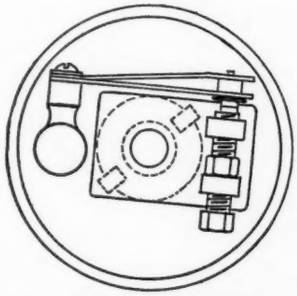
It has proved, however, that the continuous running at high speed, coupled with extra vibration, calls for a larger factor of safety both electrically and mechanically, while there is also, of course, a strong demand for a reduction in weight, despite the fact that the easy way to counteract the adverse conditions would be to make the machine larger and heavier. The problem is being met and several of the magneto manufacturers think that they have already solved it. Probably in another 12 months it will no longer be a problem.

There are two principles of magneto design; one has the coil wound upon the armature and the other has no wires on the armature whatever. The former type was evolved from the ordinary dynamo with, of course, permanent magnets. Some of the first machines had only a low tension winding in the armature and took the current from this through a separate coil which had both a primary and secondary winding. In other words, the current from the armature was merely substituted for current from the battery, the remainder of the system being identical for both sources of supply. A natural development was to eliminate the coil by placing the secondary winding directly on the armature.



In the Bosch type of circuit breaker a bell crank carrying the moving contact point turns with the armature shaft, the cam being on the inside of the breaker box

In the Dixie breaker a bell crank is used in conjunction with a cam which is fitted to the armature shaft



The Eisemann contact breaker consists of two springs separated by a fiber distance piece. The spring member nearest the center carries the movable, rotating contact point

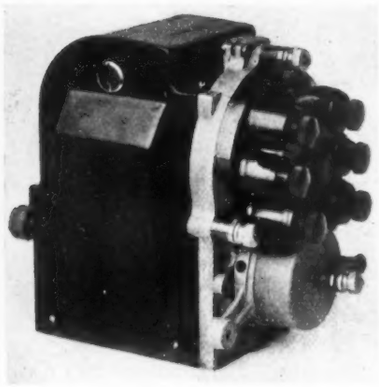
The other system is entirely different. In it there is a small coil with high and low tension winding and this has a soft iron core. The core is so arranged that it forms a circuit passing from the north pole of the magnet through the core to the south pole and back to the north pole again through the armature. The armature is then so constructed that when in one position its iron part completes the magnetic circuit and when the armature is at right angles to this position the magnetic circuit is broken, since the armature then offers to the poles of the magnet surfaces of some non-magnetic metal such as brass or aluminum, or perhaps an air space.

Properly to appreciate the exact differences between the two types a considerable knowledge of electricity is essential, but a point in favor of the second system mentioned which is easy to appreciate is the mechanical simplicity of an armature with no wires on it. In other words, the wound armature type is not so easy to make.

No Changes in Bosch

In common with most concerns in the automobile industry, the Bosch Magneto Co. has been troubled considerably in the past year by shortage of raw material. In consequence of this the company has not considered the development of any new models, having devoted all its energies to an endeavor to maintain production of the existing types. It has been giving close attention to the requirements of the United States government for aviation engines.

There have been no changes in the Bosch system or in the mechanical detail for a good many years. Bosch was among the first to perfect the high-tension magneto with both the windings on the armature and also to develop successfully a system whereby a battery could be used in conjunction with the distributer of the magneto for starting purposes. In the days of large cylinders it was usual with battery ignition and vibrator coils to start the engine by merely switching on, as it would nearly always stop with a compressed charge in one cylinder. In order to provide a similar facility without the complication of a supplementary complete battery system, the Bosch company developed a small coil and vibrator which was combined with



Latest Dixie six cylinder

the switch and either a small storage battery or a dry battery. In these days of self starters the original need for the duplex system disappeared but it will give, of course, a strong spark at very low speed or will assist starting in cold weather or with poor grades of fuel. There is a very long list of Bosch models and the tendency in recent years has been to increase the production of the waterproof types.

Dixie Has No Armature

The principal exponent of the type with a wireless armature is the Dixie magneto, made by the Splitdorf Electric Co. This machine is unique in having the magnets placed the reverse way to the usual: at right angles instead of parallel to the rotative axis. Further, there is no real armature, but the poles of the magnets rotate. The pole pieces, as shown in the sketch above, are one-sided, so to speak, and the two are connected by a non-magnetic section. Each pole piece will have the same magnetization as the extremity of the horseshoe immediately behind it. Thus, we have two pieces of iron, one with north magnetism and the other with south magnetism revolving in a circle. Mounted in the horseshoe is a coil with a soft iron core and this coil has a "leg" at each end of laminated soft iron extending downward and embracing the rotating pole pieces. Thus, referring to the sketch, in considering one leg, it is easy to see that first the north pole is switched past it and then the south pole immediately afterward. This change causes alternations in the direction of magnetism through the core of the coil and this, in conjunction with the breaker action, sends current through the windings.

An ingenious feature of the Dixie instrument is the method of obtaining spark advance. Maximum efficiency is obtainable from a magneto if the break occurs when the pole pieces and the armature are in one particular relative position. In the case of the Dixie the break should occur always when the rotating pole pieces have reached just one position relative to the legs of the coil

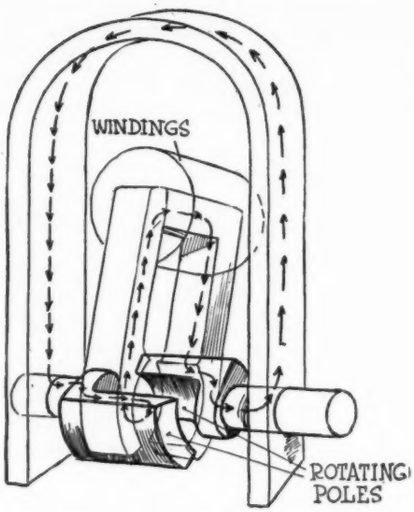


Diagram showing the path of the magnetic flux in the Dixie magneto. The windings are carried on a rocking field of laminated iron through which the magnetic lines are reversed twice in a revolution by means of the rotating poles which extend from the main magnet

core. To insure this movement the spark lever rotates the whole coil unit core, legs and all, exactly the same amount as it rotates the outside portion of the breaker. Thus the magnetic conditions are kept the same. It is possible to adjust the breaker of the Dixie while the machine is running, since the rotating portion is only a cam, the contacts, etc., being stationary.

There have been no changes in Dixie construction except a few small mechanical ones, mainly in connection with the detail of the breaker. The most important of these is a new way of arranging lubricating channels which allows just sufficient oiling to be supplied for the lubrication of the cam but prevents the accumulation of an excess. If a magneto is smothered with oil from the engine it merely drains off through an overflow channel. A slight increase in the range of advance is given on the four- and six-cylinder machines, this being changed from 30 deg. to 40 deg. and the distributer on the four-cylinder magneto has now only one carbon brush and resembles the distributer used on the six-cylinder. The present Dixie output of all types from four- to twelve-cylinder is about 1000 machines a day.

Strong at Low Speed

Unique in construction the Berkshire is another machine working on a somewhat similar principle is the Berkshire magneto, which was a new model during the year and was fully described in THE AUTOMOBILE for July 20, 1916. In this machine the magnets are arranged in the usual way and there is a rotating armature formed partly of iron and partly of aluminum. Referring to the section below, the two main poles of the magnets are A and B, while C and D are iron laminations running parallel with the armature, as shown in the other view. The iron parts of the armature are shown in black and when it is in the position shown the magnetic circuit flows from A to C through a segment in the armature, from C to D through an external circuit and from D to B through the other segment of the armature. Between the outer ends of C and D, joining them together, is a soft iron core upon which the coil is wound. Now when the armature turns so that the iron parts come opposite the poles, instead of bridging the gap between them as sketched, there is no complete magnetic circuit through the core of the coil. This means that revolving the armature continually makes and breaks the *magnetic* circuit, thus causing variations in the magnetic condition of the core of the coil. On the end of the armature shaft there is an electric current breaker of simple construction which is advanced and retarded in the usual way. A particular claim made for this machine is that it will produce efficient spark at as low a speed as 50 r.p.m., while the spark intensity does not become great enough to burn the spark plug points at high speed because the maximum spark occurs at a moderate speed. This is because it is impossible to magnetize the core of the coil beyond a certain degree, and this degree is soon attained. One of the Berkshire machines is made to deliver four sparks per revolution and this on a four-cylinder engine only needs to

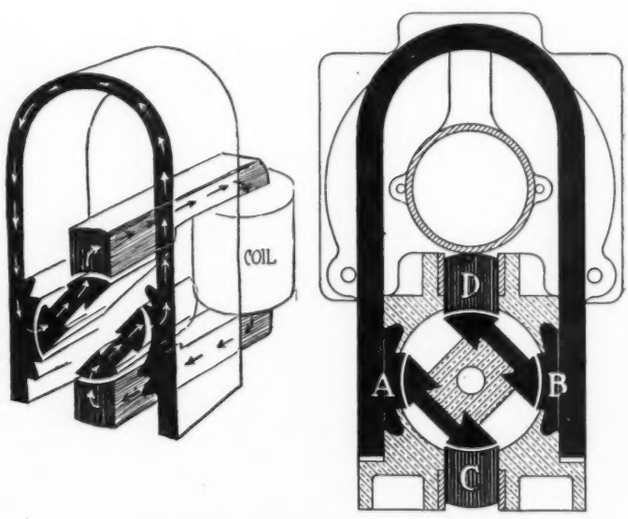


Diagram of Berkshire magneto system

run at half crankshaft speed. The four-spark type is made on six-cylinder engines to run at three-quarter speed and these two machines are applicable to eights, and twelves, by an alteration in the gearing and, of course, the distributer head. Two-spark machines are also made which will operate at the same gearing as that for most other magnetos. In the Berkshire magnetos the distributers have no carbon brushes, the high tension current being taken through brass segments projecting from a revolving cylinder of Bakelite. The outer part of the distributer is furnished with brass pins set so that there is a very small air gap between them and the segment.

Eisemann Has New Model

The Eisemann Magneto Co. is responsible for one of the very few entirely new magnetos, having added a machine which will be on the market early in January, and will be known as the G S. This is really very much the same as the G 4 in both external appearance and in principle. The mechanical detail has been changed considerably. The most important innovation is the use of a large die casting of an aluminum alloy in which the pole pieces are embedded. This single casting forms the end plates, carries the bearings of the armature and the distributer shaft, replacing eight large separate pieces and eliminating the need for a number of screws. This saving, coupled with the fact that the casting comes from the dies almost completely finished, effects a great economy in the cost of production. Therefore, the price of this new machine will be lower than that of the other Eisemann models.

Another new feature is the use of a compressed cloth gear for the distributer, this being used for the sake of quietness. The G S is a waterproof machine and has an extremely neat exterior.

For some years the Eisemann company has been making an impulse starter. This is a device which produces sparks at low speed without the addition of a battery. It may be described briefly by saying that a spring is interposed between the driving pinion in the engine and the armature shaft. When the engine is first turned over a catch holds the armature until movement of the starting crank has compressed the spring fully. As soon as this has occurred the catch is released automatically, causing the armature to fly forward very quickly. This is timed to take place just at the breaking of the contacts and a strong spark is thereby produced. As soon as the engine fires and starts to run a centrifugal device withdraws the catch and the magneto operates exactly as though the impulse starter was not there.

The company states that there has been a strong demand for this machine in the tractor field, and it expects to do a large business with the tractor manufacturers in the future.

Another Eisemann feature, which has been very successful, is an automatic spark control which is fitted to the armature of some of the machines. This is a centrifugal governor which operates a sleeve with a spiral groove cut in it which is interposed between the main portion of the armature and its shaft. As the engine speeds up the armature is therefore advanced relative to the driving gear, the breaker mechanism and the distributer, of course, being advanced a similar amount.

Remy Uses Separate Coil

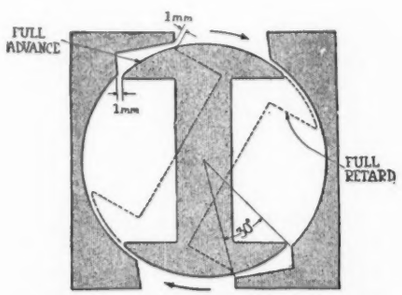
Remy magnetos have not been changed in any way this year and will retain all their present features. The Remy armature carries only one winding, this being a low tension coil of exceptionally large size. The distributer is mounted on the end plate of the machine in the usual way, the coil and condenser unit being entirely separate. The switch is built integrally with the coil so that the latter lies immediately back of the cowlboard, and all Remy machines are arranged to furnish dual ignition, the switch having a position which allows battery current to flow through the windings of the coil and of the armature. In this way the battery current supplements that produced by the armature and insures a satisfactory spark for starting.

A very useful feature of the Remy machines is the device known as the timing button. This automatically locates the armature and distributer in the firing position of No. 1 cylinder. To use this the magneto is disconnected from the engine and the crankshaft is set so that the piston in No. 1 cylinder is at the top of the stroke. The timing button is then pressed and the armature turned by hand until the button is felt to catch. The magneto is then in the correct position and if coupled to the engine without further movement the ignition will be set correctly.

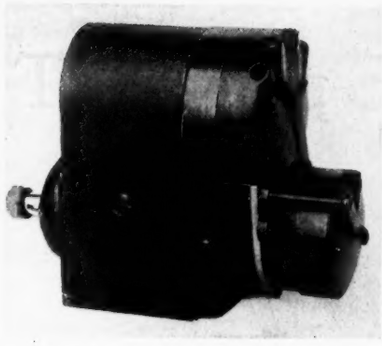
Simms Has Four Models

Developed by some of the same individuals who designed the original Bosch machines, the Simms Magneto Co., with factories in America and Great Britain, originally built a magneto practically identical in system with the Bosch. In the course of years of manufacturing, mechanical differences have developed so that the Simms and Bosch machines of to-day have very little similarity. At present only four machines are being produced, two for four and two for six-cylinder engines, one furnishing single ignition and the other dual. The single ignition types can be converted to the dual by changing the breaker box and a few other parts.

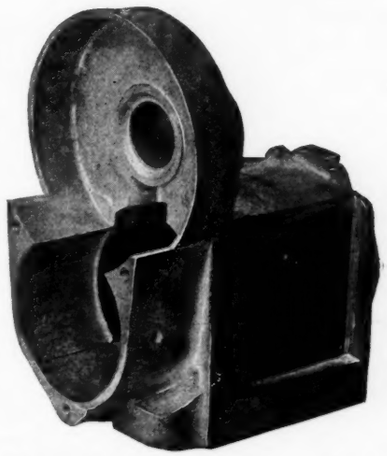
A special feature of the Simms machine is the design of the pole pieces which have extensions on the edges following the direction of rotation of the armature. These extended edges keep the edges of the armature shuttle within influence of the pole in all positions from full advance to full retard. That is to say, that at the moment of breaking the current the edge of the shuttle is never widely separated from the edge of the pole piece. The possession of one very large contract has heretofore made it difficult for the company to accept much other business, but it is expected that the manufacturing facilities will be much enlarged within a few months.



Special pole piece used on Simms magneto to give equal spark intensity at all speeds



New Eisemann type G S magneto



Die casting used in Eisemann magneto The pole pieces are cast in place and hardly any machining has to be done on this whole piece, which replaces nearly twenty small parts used in the older designs

Spark Type Affects Power

Scientific Tests Show Character of Mixture in Cylinder Affects Quality of Spark Required to Insure Quick Ignition —Successive Sparks May Ignite Where a Single One Fails

By J. D. Morgan

THE following article from *Engineering* (London) although of an extremely academic kind, is none the less very interesting to all who have followed the spark controversy which has been raging more or less ever since the first days of electric ignition. The author is an independent investigator, and a member of several scientific societies, so his opinions are worthy of the most respectful consideration.

Two Contradictory Opinions

"There are current among engineers two opposed beliefs regarding the effects of spark intensity on ignition in internal combustion engines. According to the one, provided a spark is sufficiently strong to produce ignition, an increase of strength has no effect on either the rate of combustion or the maximum pressure attained; consequently such increase has no effect upon the power developed by the engine. According to the other the strength of the spark does have an effect upon the power, and it is therefore assumed that the spark strength influences both the rate of combustion and the maximum pressure attained. Obviously both assertions cannot be true, yet it is possible that the one which is untrue has some foundation in fact, and has arisen out of a misinterpretation of experimental results.

"Regarding the terms 'strength' or 'intensity' as applied to sparks for ignition purposes, no clear meaning is or can be attached to them. The terms are unsuitable because as ordinarily used they refer to the total heat energy of a spark, and this alone does not determine the ability of a spark to ignite a given gas mixture. To meet the difficulty the term 'incendivity' has been proposed by the writer* to denote the property whereby a spark produces ignition of a combustible gas. The term is convenient for descriptive purposes, but no quantitative definition can yet be given. In the absence of a standard of incendivity sparks are ordinarily compared by measurements of their heat contents, except in special cases where they are referred to the energy supplied to the circuit which produces the sparks.

Tests in Special Vessel

"The principal investigations on the subject of spark ignition in internal combustion engines have hitherto been carried out by means of engine tests, the effects of different sparks being observed either on explosion diagrams or brake measurements. For the purpose of the investigation here recorded it was decided to explode in a chamber of constant volume weak, quiescent gas mixtures at normal temperature and pressure, for the reason that the main facts can be more easily and definitely determined in this way than in engine tests, where the variable factors of the problem are less easily controlled. The sparking was in all cases at one position, this being approximately at the center of the explosion chamber.

"In carrying out the experiments a mixture was found by trial which produced explosions of moderate rapidity, as the indicator diagrams of such explosions can be more easily and accurately compared than those obtained by very rapid or very slow explosions. Using throughout a coal gas mixture of the same composition, sparks from the following sources were employed:—

(*a*) High-tension magneto.

(*b*) Induction coil with cam-operated make-and-break (primary supplied by 12-volt circuit).

(*c*) Induction coil with vibratory make-and-break (primary supplied by 4-volt circuit); 200 vibrations per second.

(*d*) Lodge condenser apparatus, vibratory make-and-break (primary supplied by 8-volt circuit); 70 vibrations per second.

"The above are the principal types of apparatus used in practice. The heat contents of the sparks measured by means of the author's thermal balance were as follows:—

(*a*) 0.01 joules per spark at 120 r.p.m.
0.03 joules per spark at 1000 r.p.m.
(*b*) 0.02 joules per spark at 80 r.p.m.
0.0018 joules per spark at 1000 r.p.m.
(*c*) 0.0005 joules per spark.
(*d*) 0.026 joules per spark.

"In all cases the diagrams were identical, both as regards the rate of combustion and the maximum pressure. From this it is evident that provided a spark is capable of producing ignition, increase of incendivity has no effect upon the power developed in the engine. This result confirms what has previously been ascertained from engine tests. The fact has not yet, however, met with general acceptance among engineers.

What Is Spark Strength?

"Having regard to the foregoing, the question arises: What ground is there for the belief that engine power is affected by the incendivity or so-called strength of the igniting spark? The experience is common among users of internal combustion engines that an increased spark sometimes results in improved operation of an engine, particularly when weak explosive mixtures are employed. The answer is to be found in the fact that an explosive gas mixture requires for its ignition a spark having not less than a certain incendivity, and the latter varies with the nature and proportions of the mixture. When the proportions of the mixture are at or near the upper or lower limits beyond which ignition is impossible the required incendivity is high. But as the proportions approach that of maximum explosibility the required incendivity rapidly diminishes. Hence for a given gas mixture a certain minimum incendivity is necessary in the spark. If the incendivity is near the limit a diminution in the explosibility of the mixture may result in no ignition, or only intermittent ignition. This can be rectified by employing a spark of higher incendivity, providing a greater margin for gas variations. In a gasoline engine, particularly when running at slow speed, weak mixtures requiring strong sparks for their ignition are often obtained, and when the ignition system is insufficient to provide suitable sparks defective operation of the engine ensues. On replacing the ignition system by another producing stronger sparks the engine works satisfactorily. Arguing from this, the user concludes that the better spark has

* "Notes on the Ignition of Explosive Gas Mixtures by Electric Sparks." Vol. 54, No. 254, Journal of the British Institution of Electrical Engineers.

increased the power of his engine by increasing the rate of ignition or the maximum pressure, whereas actually it has only eliminated misfires.

"From the practical standpoint the facts relating to 'single point' spark ignition in internal combustion engines are comprised by the statements (1) that provided a given spark is sufficient to produce ignition any increase of incendivity does not affect the power obtainable from the explosion, and (2) that as the mixture passes from the proportion of maximum explosibility toward the higher and lower limits the required incendivity of the spark increases.

No Theory of Ignition

"An outstanding and as yet unsolved problem in connection with ignition apparatus for internal combustion engines is that of defining the least sparks required to produce ignition of a specified gas mixture, and with this problem is associated in general that of spark measurement. In the absence of an established theory of ignition any attempt to define a spark must necessarily be tentative, but some satisfactory temporary expedient is not impossible. Obviously the procedure of defining a spark in terms of the current in some part of the apparatus used for producing the spark is highly unsatisfactory, because sparks defined in this way are not comparable when produced by different apparatus. Any satisfactory method of spark measurement must involve nothing more than the spark. The most obvious and up to the present best developed method is the thermal one. In this it is usual to heat a quantity of gas by a succession of sparks until a steady state is reached, that is, the heat imparted to the gas is equal to the heat lost by the container. The average heating effect of the sparks can then be calculated and the heat content expressed in joules per spark. At first sight it would appear that the incendivity of a spark could be expressed as a function of the heat-content, and if this were possible sparks could for practical purposes be defined in terms of joules per spark. There are, however, two facts which limit the usefulness of the thermal method. The first is that incendivity does not depend upon heat alone, but apparently on heat jointly with temperature, and the other that ignition seems to be the result of a cumulative action which can be set up by a succession of sparks when a single spark fails.

Temperature Important

"It is a matter of simple experimental proof that heat alone does not determine the incendivity of a spark. Using the same source of energy, say a magneto, two different types of sparks can be obtained, one by using the magneto normally and the other by connecting a condenser across the spark gap. The latter is contained in an explosion chamber which is filled with a weak gas mixture, and the magneto is adjusted so that working normally it produces a spark which will not ignite the gas. A condenser of suitable capacity is then attached across the gap, and by means of the resulting spark the gas may be exploded immediately. On measuring the thermal contents of the sparks it is found that the heat contained in the normal magneto spark is not less than that obtained with the condenser, and if a poor condenser is used it may be as much as 100 per cent more, as in one set of experiments carried out by the author. Yet the spark containing more heat failed to produce ignition where the other succeeded. The only apparent difference was the temperature. It might be suggested also that the duration was different, and the shorter duration of the condenser spark caused it to be accompanied by greater mechanical violence. But for this there is no experimental evidence. Both sparks are oscillatory, and the effective portion has apparently the same duration in both cases. It follows, therefore, that incendivity is not a function of heat only, but of heat and temperature. And as the heat-measuring instrument accounts only for total heat, the measurement of joules per spark is only useful for comparing sparks produced by similar apparatus.

"The second fact, that ignition appears to be the result of a cumulative action, is of less practical importance in connection with ignition apparatus for internal combustion engines, seeing that single sparks are now more generally used. But for purely theoretical work the fact is of importance. Using a magneto provided with a variable resistance in its primary circuit to permit large variations of the spark in the secondary circuit, and employing a needle point spark gap, very small sparks can be obtained. Keeping the gas mixture constant and varying only the speed or the primary current of the machine, it was found possible to arrange a condition in which the gas would never ignite with the first spark, and only after a number of sparks had been passed through could ignition be produced. Owing to the extreme difficulty of insuring perfect uniformity of conditions (a trouble which is common in work of this kind), the results were not sufficiently regular to permit of a quantitative deduction, but the persistence of the phenomenon was such at all times that only one conclusion was possible, namely, that succeeding sparks produced a progressive change in the gas which finally resulted in ignition, in other words, the ignition was the result of a cumulative action. The pre-ignition period could be shortened by increasing the strength of the spark (viz., by increasing the speed or the primary current), or by adding a condenser across the spark gap. The largest pre-ignition period noticed was about 2 seconds with the magneto running at 5 r.p.m. In a previous investigation* using low tension sparks the author observed a similar effect. The results obtained with the less active sparks were more regular and the pre-ignition interval was longer. Having regard to the foregoing, the difficulty of defining the least igniting spark for a given gas is apparent, but, as previously stated, where under practical conditions only one spark (or a plurality of simultaneous sparks) is used for igniting an explosive charge the difficulty disappears.

Condenser Effect Important

"The trend of scientific opinion concerning spark ignition is that the action is ionic. It is not suggested that the heat of the spark is unrelated to the process of ignition, but that the thermal and ionic conditions are intimately connected. A natural alternative, if not a substitute, for a thermal instrument for measuring incendivity is the electroscope. The application of the latter for this purpose is not easy, because a number of arbitrary conditions, such as the shape and position of the spark gap relatively to the charged surfaces, and also the magnitude of the charge itself, have apparently to be stipulated before measurements can be usefully compared. Nevertheless the electroscope appears to contain useful possibilities in this connection. It is a matter of simple experimental verification that the sparks of a condenser produce a larger discharge per spark than do sparks obtained when the condenser is removed, although the heat content of the latter may be the same or even greater than that of the former."

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Goodyear Cord Tires Easy to Repair

WHEN a Goodyear cord tire has ben damaged it is not necessary for the automobilist to send the tire to the factory for repair, according to L. C. Rockhill, manager of the automobile tire department of the Goodyear Tire & Rubber Co., Akron, Ohio. Any tire repairman can repair one of these cord tires just as he would a fabric tire, using regular fabric, without impairing the efficiency of the casing. For this work no special machine is necessary. In the Goodyear construction six to ten layers of strong cords are used, the number of layers depending upon the size of the tire. The method of applying these cords gives rise to the name of the thread system by which it is widely known. The cords are held in place by a few very fine threads which break when the tire is used, leaving only the cords.

The FORVM

Correctly Figuring Valve Capacity

By E. H. Delling

IN reference to the article entitled Valve Sizes Need Definition on page 703 of THE AUTOMOBILE for Oct. 26, may I be permitted to criticize the suggestion that the area of the clear valve diameter minus the area of the stem should be given as a basis of comparison?

I am of the opinion that it is altogether wrong to consider the area of the valve port as an indication of the "valve capacity," if I may call it so. An example will illustrate my point very clearly. The full-size sketch, Fig. 1, shows the actual dimensions of a valve of the 22-70-hp. Mercer engine.

Employing these few figures we would have a clear valve area of $\frac{2.25^2.\pi}{4} = 3.97$ sq. in. Subtracting the area of the valve stem, which is 0.110 sq. in., leaves 3.866 sq. in. as the value which your article proposes. Now let us see what actually offers the greatest restriction to the incoming charge. Considering the valve in the extreme, lifted position, the gas will follow the contour of the seat and escape through a slot the length of which is the clear diameter of the valve multiplied with π and the width of which is a line connecting the small diameter of the valve with the largest diameter of the seat. We will call this width h_1. We then obtain the following expression if we call the effective maximum valve opening O_{max}:

$$O_{max} = (d + b)\pi.h_1$$

In our case we would have

$$O_{max} = (2.25 + 0.125)\pi.0.328$$
$$= 2.45 \text{ sq. in.}$$

This is the actual opening, and comparing it with the port area minus the valve stem, we find that it is only 63.3 per cent of what the former article assumed as correct.

Still this absolute value of 2.45 sq. in. does not permit comparisons and I think we should go a step further. I have always made it a rule to express such values specifically, *i.e.*, per liter or cubic inch of piston displacement. As the Mercer engine has 298 cu. in. displacement, we would have 0.033 sq. in. available for each cubic inch of gas taken in, assuming that the volumetric efficiency is 100 per cent. This value allows a direct comparison of any size and lift of valve for any displacement. The above consideration is the prime reason for double inlet valves. I have never seen this reason stated clearly in any article on that subject. H. R. Ricardo, in a treatise on High-Speed Engines in *The Automobile Engineer* for August, 1916, page 225, states:

"Now the effective area of opening of a poppet valve is equal to the area of the port when the lift is equal to one quarter of the diameter (this is not strictly true but is very nearly so)."

This statement in itself is correct, but it is based on an assumption which is out of the scope of everyday practice. I cannot recall a modern stock engine with such a tremendous lift except the Vauxhall Prince Henry model which, however, can hardly be called a stock product and which represents a very small percentage at any rate. Most valve lifts range from 5-16 to ⅜, very seldom more. So why assume something which is not the average but the exception.

He then proceeds to replace one valve of 2.2 in. diameter by two of 1.55 in. diameter, the combined port area of which would equal that of the single valve. With a lift of current practice, say ⅜ in., we would obtain by above formula for the single valve an opening of $O_{single} = 2.43$ sq. in., for the double valves $O_{double} = 3.45$ sq. in. It will be observed that the gain is appreciable, 42 per cent to be exact.

Some designers may object to using the same lift for the large as well as the small valve. But there is no reason why a small valve should not be lifted as high as a large one, in fact it is much easier to accelerate the small mass of the light valve. I always regarded the lift a factor of the cam shape, spring tension and timing and not so much of the valve size.

Assuming an intake opening of 5 deg. after D. C., a closing of 45 deg. after D. C. and a tappet clearance of 0.005 in., we will have a valve period of 120 deg., or 60 deg. is the included angle formed by the cam flanks. If we assume a base circle of commercial practice, say 1¼ in. diameter, we shall find that lifts over ½-in. are practically impossible due to the fact that the cam shape approaches a point.

To sum up we can come to the conclusion that the valve capacity of an engine changes in direct proportion to the diameter of the intake valves multiplied with the number of valves *and not with the square of the diameter* as is often assumed. That means, 12 intake valves of 1½ diameter have a certain capacity, and whether they are arranged as single valves in a twelve cylinder or as double valves in a six cylinder, is secondary consideration. This assertion is backed up by the high speed of the Sunbeam six-cylinder racing car with double valves and of the Packard racing car with twelve-cylinder aviation engine, having single valves. Both cars have twelve intake valves available for the passage of the inrushing charge; therefore their high volumetric efficiency. Whether the gas is burnt in six or in twelve cylinders is immaterial from the standpoint of valve capacity.

A New Semi-Diesel Engine

By Edwin S. Strickland

AS an experimenter on two-cycle and semi-Diesel engines I have developed a type of construction which entirely overcomes such defects as: Hard starting; backfiring; fouling; waste of unused fuel; accumulation of carbon; condensation of mixture before explosion; and bad or uncontrollable regulation

The first four defects existent in two-cycle engines of the carbureter type are due to co-mingling of fresh and exhaust gas which does not occur with clean air as a scavenger in the semi-Diesel principle.

The last three defects existent in semi-Diesel engines are overcome by varying the quantity and temperature of air compressed, in proportion to the oil atomized against the com-

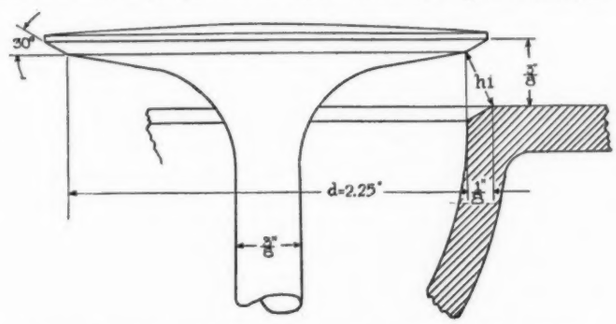


Fig. 1—Full-size sketch, showing actual dimensions of a valve of the 22-70 hp. Mercer engine

At the right are reproduced the two illustrations, Figs. 4 and 5, from an article on engine testing by W. Ferrier Brown in The Automobile Engineer, England, and reprinted in digested form in THE AUTOMOBILE *for Oct. 12. Fig. 4 gives four efficiency curves, viz., mechanical efficiency, brake thermal efficiency, indicated thermal efficiency and available efficiency (as compared with the air standard). Fig. 5 shows the relative values of the "air standard" and the "maximum available" efficiencies as a percentage of the total heat energy of the fuel consumed.*

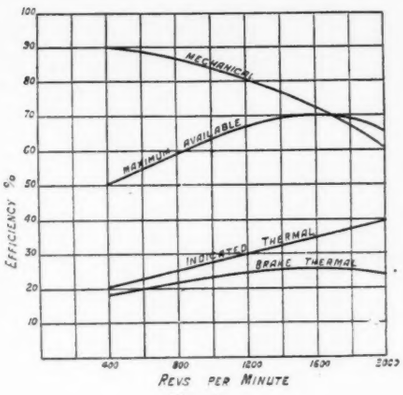


Fig. 4

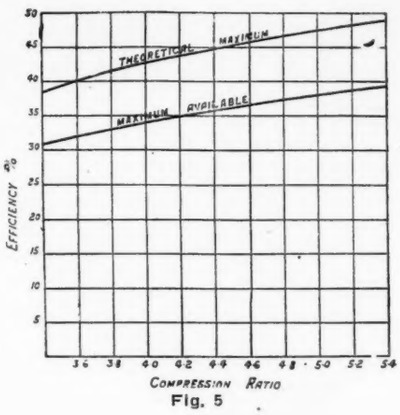


Fig. 5

bustion plate; no partial vacuum is formed in the cylinder.

Kerosene is used for fuel and will operate under idling conditions, while gasoline is used for starting purposes only.

Further improvements consist of a vacuum-breaking valve in the exhaust pipe to prevent drawing the scavenging air cut of the cylinder; a circulation of oil around the bearings, serving the double purpose of lubrication and of forming an oil-seal to prevent compression escaping from the crankcase; a bumped piston head is used to prevent sizing and also to protect the rings from the heat of the explosion; a small fly-ball regulator permits rapid advance of spark and compression by the operator without liability of stalling or reversing. The fly-ball regulator also varies the regulation of warm air to the intake pipe in order to maintain a normal temperature of air admission; and a water-cored exhaust port bridge prevents sizing of same against the piston, while an air passage of 45-deg. angle to the cylinder insures scavenging with no resistance to the air as in a right-angle passage deflector.

The above improvements in connection with the inherent advantages of 40 per cent reduction in parts and weight, cheaper fuel, less surface to lubricate, an explosion each revolution, with no valve in the combustion chamber, make this type of engine the ideal and ultimate motor.

Brake Thermal Efficiency Error

By R. W. A. Brewer

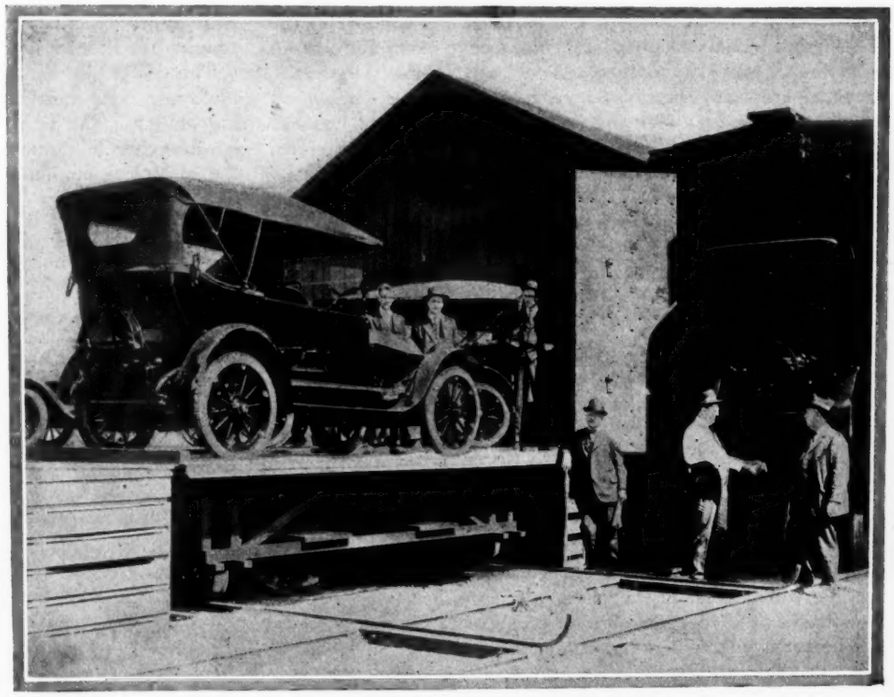
IN Mr. Clayden's abstract of W. F. Brown's article on testing engines, page 620 of THE AUTOMOBILE, Oct. 12, there is apparently an error in respect to the brake thermal efficiency.

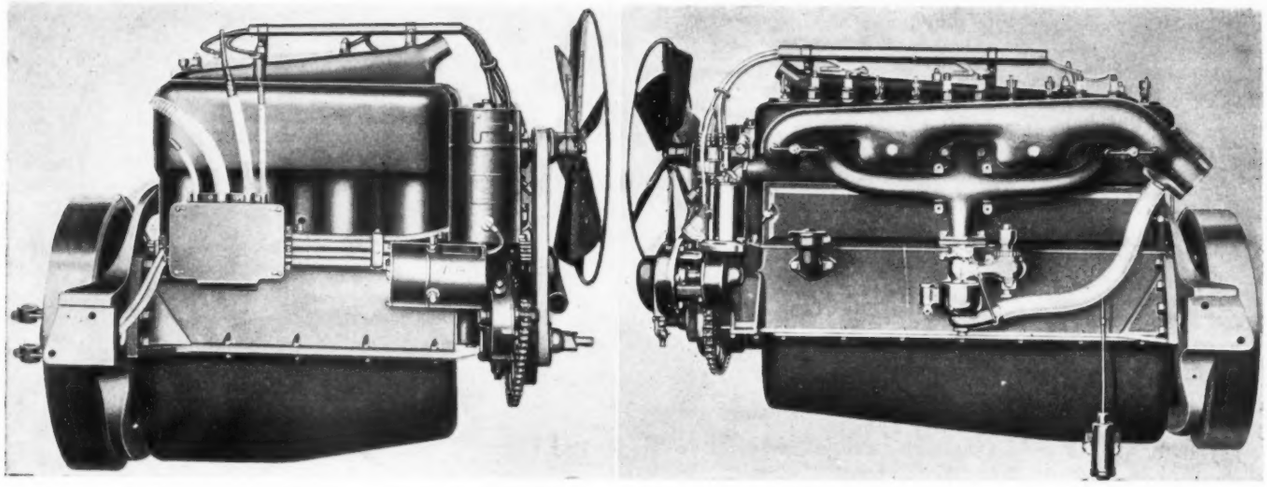
Direct Values Given

It is stated that Fig. 4 shows a "curve of the brake thermal efficiency taken as a percentage of the maximum available efficiency shown in Fig. 5." A study, however, of the curve in question would show that the values given are direct values and indicate the proportion of the total fuel which actually appears as work at the crankshaft of the engine, and this is of the order of 20 to 25 per cent of the total heat in the fuel. Going a step further, the curve in Fig. 4 shows 25 per cent as its best value and assuming the compression ratio of 4 to 1, the "maximum available" from Fig. 5 shows about 34 per cent, so that the ratio of the actual to the maximum available is about 73.5 per cent.

A Car Unloading Platform

AT the right is illustrated a unique device for saving time in unloading automobiles from freight cars. It is the invention of C. A. Dundas, Studebaker dealer in Riverside, Cal. It consists simply of a platform on a level with the height of the freight car floor, the platform being on wheels and moving over tracks. The automobile is rolled off the rear of the freight car and onto the movable platform, the illustration showing one car which has just been rolled on the platform and a second in readiness. The Santa Fé railroad officials thought so well of the scheme that they have made arrangements with Mr. Dundas, the inventor, to have the device installed. The unloading of automobiles at their destinations has long involved a waste of time, which is eliminated by this platform, the expense involved being small.





Left—Engine of the Studebaker four, illustrating junction box for wiring at rear, vertical generator mounting, and chain drive starting motor. Right—Carbureter side of engine shows the arrangement of manifolds on the Studebaker six

Studebaker Continues Four and Six

Redesigned Piston and Electrical System Chief Mechanical Changes—New Patent Auxiliary Seats

STUDEBAKER four- and six-cylinder cars are to be continued for 1917 with several minor changes. As far as the basic design is concerned, the cars are unaltered, but they are presented this year with better finish, better equipment, and better engine characteristics than last year, at a price increase of $130 on the six-cylinder touring car and $55 on the four. Both of these are seven-passenger cars selling respectively for $1,180 and $940.

From an exterior standpoint, the most striking alteration in the Studebaker cars is the use of a gunmetal finish. This is a twenty-five-operation job and the fender trim is in black, giving a distinctive appearance to the new model. Besides the change in finish, there have been a number of other body improvements designed to give more room and comfort to the passengers. The new auxiliary chairs have arms and are an exclusive Studebaker design. They are roomier than the previous auxiliary seats and instead of folding up behind the front seats or under the floor, they are carried beneath the back seat, thus when the auxiliary seats are out of sight, as far as appearance is concerned, this is a five-passenger car.

Another innovation is the use of a reversible front seat. With this the passenger seated beside the driver can sit facing the tonneau or facing forward as he desires. Both the front seats are covered with leather and are fitted with robe straps and are adjustable to all leg lengths.

Another comfort feature is the use of the Blackmore patented storm curtains which open and close with the doors, thus giving all the conveniences of an inclosed body when the side curtains are in place. For those who desire a permanent top in winter there is a new form of convertible which is made exclusively for the Studebaker product and which can be removed readily and the summer top substituted.

Along with the more comfortable body and the better finished exterior, the interior has been given a considerable amount of attention. There are now door pads on the doors. The upholstery is all in semi-glazed, straight-grained genuine leather with curled hair. The tonneau carpet is all wool and bound with leather. The top is silk mohair bound with leather edging, and in the way of interior equipment a new Yale switch lock of pin-tumbler type has been added to guard the car against theft.

New Studebaker auxiliary seats which fold beneath rear seats

Pistons 5 Ounces Lighter

Mechanically, the improvements are very slight and only of a detail nature. Probably the most important is a reduction of 12½ per cent in the weight of the pistons, making them 5 oz. lighter than in the 1916 cars. This reduction in weight has been accomplished by milling out the skirts.

The oil pump has been changed slightly in the way of making a tighter fitting pump which has increased its pumping ability. The rear axle has been stiffened and strengthened, giving a higher factor of safety in this part, and in the electrical equipment, improvements in the design have increased the cranking power by 12 per cent., this increase in the electric cranking effort being due to improved winding of the motor. The generator has also been improved by alterations in the wiring which give much better charging characteristics. About 3 amp. increased current is furnished the battery at a car speed of 15 m.p.h., while the maximum charging rate has not been altered. The practical result of this change as it concerns the driver is that the slow speed operator will get better charging performance and the battery will not be injured by the faster driver. Another detail change in the electrical equipment is in the headlamp mounting by means of which the lamp can be turned and fastened in any position.

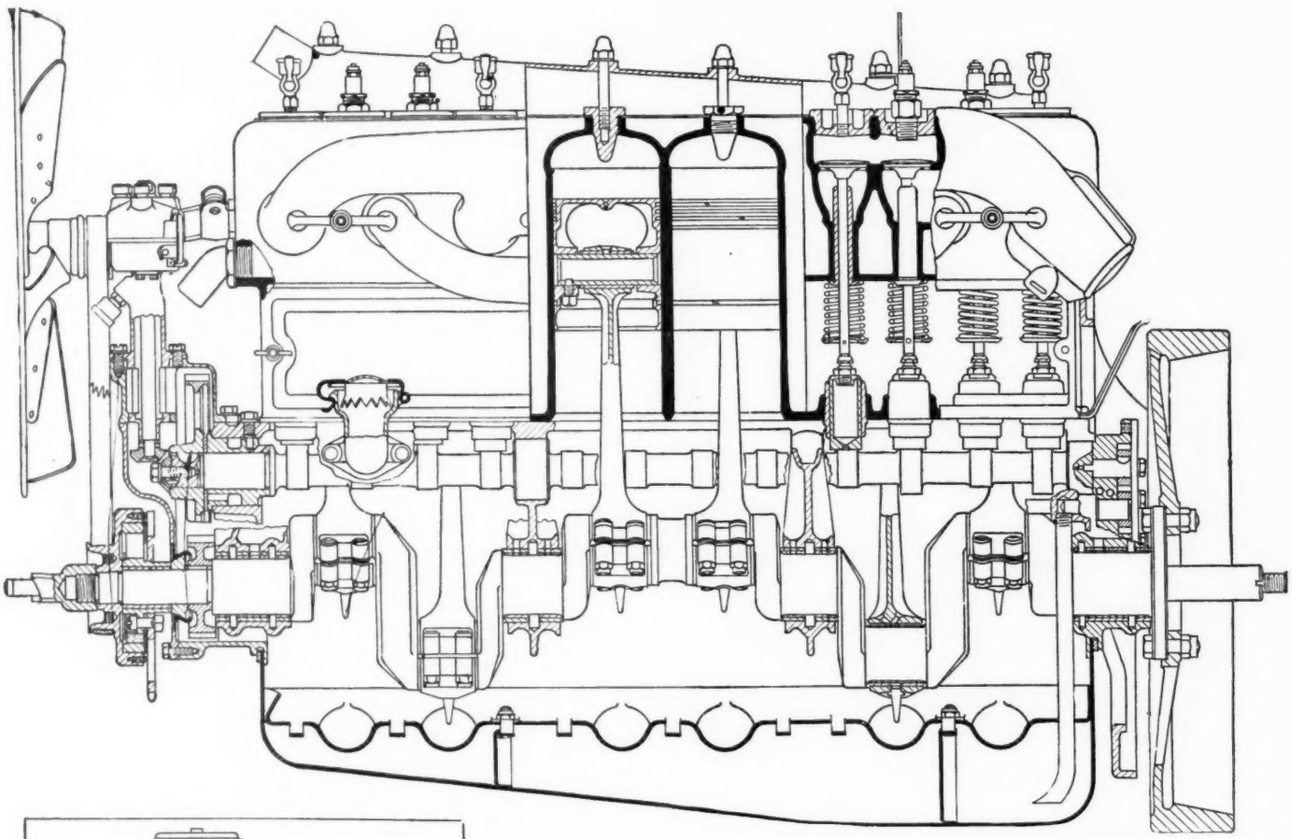
From a manufacturing standpoint, the outstanding feature of the Studebaker line is its standardization. The four and six are exactly similar in design throughout, both engines having their cylinders cast in a single block of similar dimensions, 3⅞ by 5 in., and with all parts similar from one end of the chassis to the other; excepting where structural dimensions differ on account of the difference in the power plants.

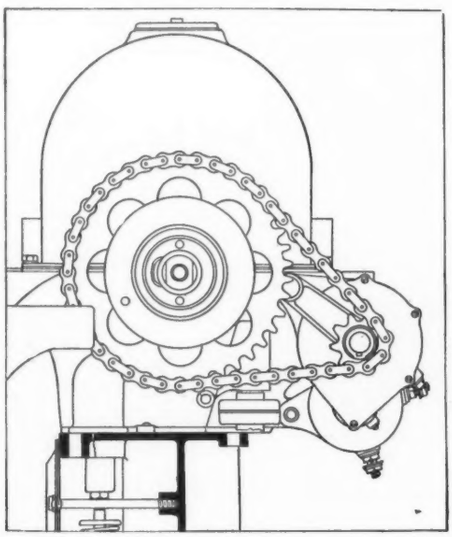
For 1916 Studebaker cars were redesigned and a considerable number of alterations were made in the power plants. For 1917, the engines which were introduced have been continued practically without a single change. The other Studebaker characteristics have also been continued this year and the rear axle gearset, cone clutch, and Wagner electric units are all found in the latest models. In the cars of 1916 the cowl gasoline tank was used for a time, but this was changed over so that on the 1917 models there is a vacuum feed from the rear tank.

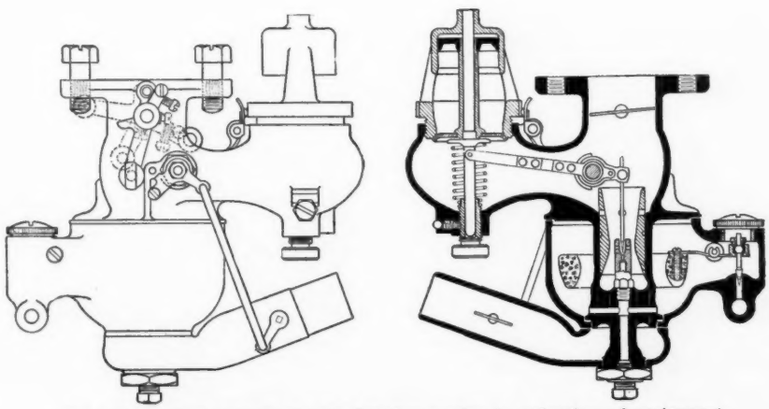
Both the intake and exhaust manifolds are on the left with the carbureter carried on a horizontal flange at the bottom of the intake header. A particular feature of the intake manifold is in the smoothness of the interior surface and the elimination of sharp bends. The hot air stove is attached to the exhaust manifold at the rear of the engine and is carried direct to the air intake of the carbureter by a flexible tube.

Connecting Rods Taper

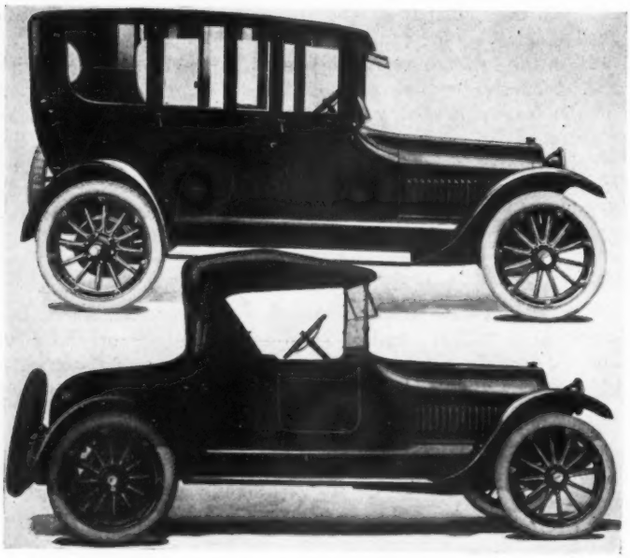
Cylinders follow conventional design as illustrated in the sectional drawings, and a noteworthy feature of the connecting-rods is the taper from top to bottom in order to give a constant strength column between the wristpin and



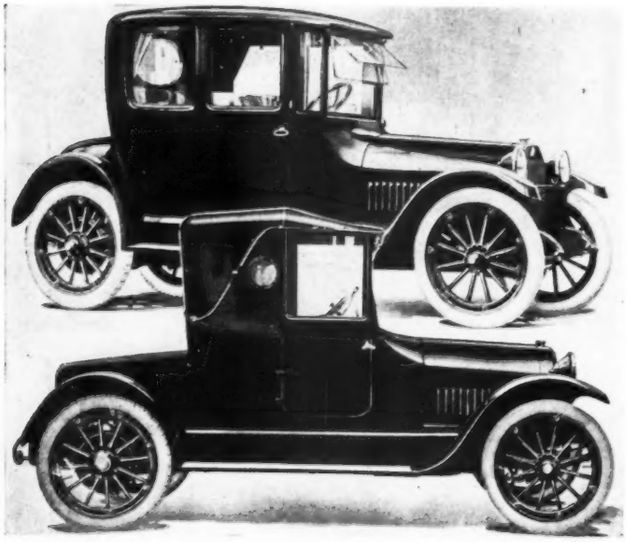




The principal change in the Studebaker engine is reduction of reciprocating weight. Observe the large water spaces round the valves
The small views show the roller chain drive for the starter and the carbureter with fuel and air adjustments



Above—Convertible design or Every-Weather type which fits over the standard touring body. Below—Side view of the roadster body with full equipment



Upper—Studebaker six-cylinder, four passenger coupé. Lower —Landau roadster which makes a convenient car for physicians and professional men

the crank pin bearing. The center lines of the connecting-rods are slightly offset, as will be noted from the longitudinal section. In the six-cylinder engine the crankshaft is carried on four main bearings, and in the four there are three main bearings. The entire assembly of piston, rod and crankshaft is featured by high strength factors secured by liberal dimensions. The wristpin is secured in the piston boss by a set screw and the bearing bronze for the upper rod bearings secured in the upper end of the rod. At the lower end of the rod there are four alloy steel bolts provided with shims between the cap and bearing for adjustment.

No alteration has been made in the valve action. The camshaft is driven by helical gears directly from the crankshaft and the tappets are the same constant-diameter units adopted last year. These cylindrical pieces, being of the same diameter at the bottom as they are at the top, can be drawn from the crankcase by simply lifting the valve and the spring out of the way.

Lubrication is by a circulating splash system with a gear pump. The oil is driven from the crankcase reservoir through a lead running the entire length of the crank case with a duct to each of the main bearings. The oil is forced through this and the pressure under which it is being fed is registered upon a gage mounted on the dash. The oil passing through the entire length of the main lead flows to the timing gears and acts as their lubricant. The overflow from the main bearings enters the splash troughs where it is picked up by the scoops at the bottom of the connecting-rods.

Electrically, the Studebaker car is Wagner equipped. The starting and lighting system is a two-unit outfit with the motor and generator both mounted on the right. The generator is mounted vertically and driven from the helical gears in mesh with the crankshaft gear. The starting motor engages the crankshaft through a chain drive and is provided with an over-running clutch which releases the starter when the engine is running.

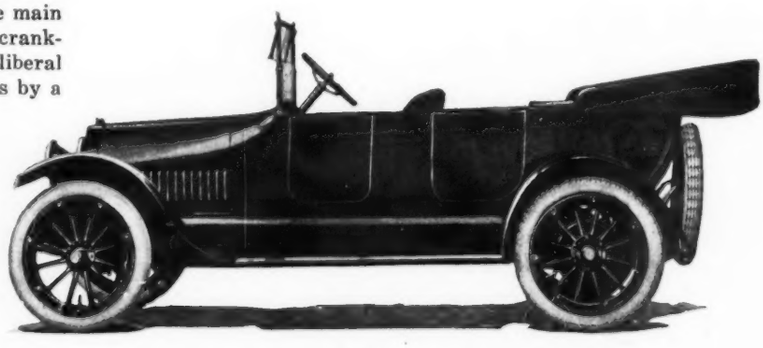
The torque exerted on the crankshaft is over 200 ft. lb., the energy being supplied by a three-cell, 6-volt, 100-amp.-hr. Willard battery mounted under the front seat. For ignition there is a Remy coil and distributer. The headlights can be focussed on any spot desired, and these, together with the dimming device, speedometer and tail lights are controlled by dash switches.

Single Wire System Used

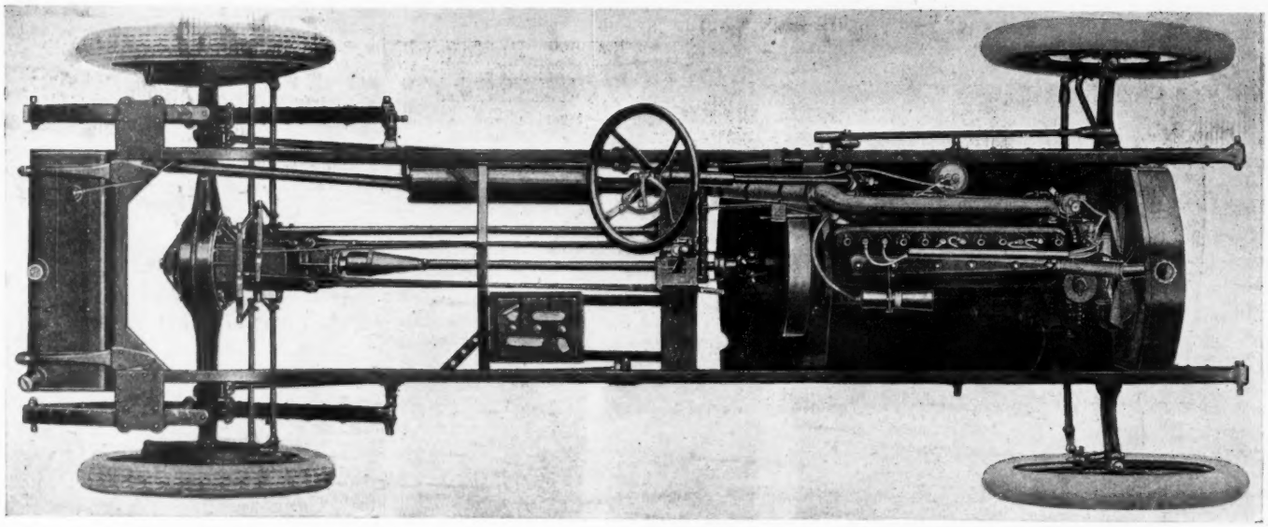
Particular attention has been given to the wiring which is a single system, grounded-return, with the wires carried in flexible metal conduits. The feature introduced last year of placing a junction box on the rear right side of the engine, where it is very accessible, is continued. All the wires go to this box and there are practically none on the body except to the control apparatus on the cowl. Four screws hold the cover plate on the junction box, giving access to any of the connections for the entire system. When the body is removed from the chassis there is no need to make a number of disconnections and furthermore the connections should not work loose, as they are all very rigid. The entire system operates at 6 volts.

The clutch has a pressed cone, the facing being mounted on easy-engaging springs and the throw-out device connected to a ball bearing collar. The drive is direct from the rear clutch member to the gearset at the rear through a 1 5/16 in. alloy steel propeller shaft fitted with a universal at each end. The gearset is bolted by means of a flange to the pressed steel housing of the rear axle and carries on its left side a torsion rod which connects to the main cross member of the frame just behind the forward end of the propeller shaft.

There are also two radius rods which are attached to the side members of the frame with flexible connections to allow for rear spring action, while preserving the alignment of the rear axle. A gear reduction at the axle of 4 to 1 on the



Studebaker series 18 seven-passenger touring car

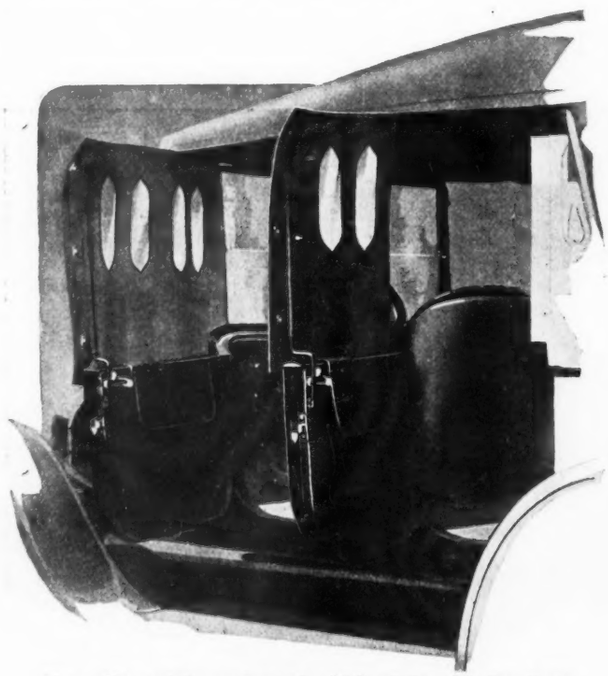


Plan view of the series 18 Studebaker six-cylinder chassis, showing layout of driving and torque members

four and 3.7 to 1 on the six is employed. The three-quarter elliptic spring suspension adopted last year has been continued, the springs being underslung beneath the axle. On both cars they are 51 in. in length with 38-in. front springs.

Wheelbases Differ

On account of the greater engine length there would naturally be a longer wheelbase on the six than on the four. There is a 10-in. difference in this respect, the four having 102 in. and the six 112 in. The tire equipment is 34 by 4 straight side on both cars. Non-skid safety treads are furnished in the rear, while each car is provided with a tire carrier at the rear of the body, together with an extra demountable rim. The wheels are artillery type covered by heavy pressed steel crowned fenders with clear running boards covered with corrugated rolled aluminum. The brakes operate on a 15-in. drum, the service brake having a 2-in. face width and being a contracting type. The hand brake is expanding and has a 1¾-in. face width. The steering gear is an irreversible, full worm-and-wheel type.



New side curtain equipment which opens with the doors

The body line is complete on both the four- and six-cylinder chassis, the cars now listed including the following:

Four-cylinder models:	
Chassis alone	$850
Roadster	930
Touring Car	940
Every-Weather Car (Convertible)	1,140
Landau Roadster	1,150
Six-cylinder models:	
Chassis alone	1,090
Roadster	1,170
Touring Car	1,180
Landau Roadster	1,350
Every-Weather Car (Convertible)	1,380
Touring Sedan	1,700
Coupé	1,750
Limousine	2,600

Complete equipment is included in the purchase price, which in all cases is f. o. b. Detroit. The upholstery in the touring and roadster models is straight-grained leather, while the sedan, limousine and coupé can be finished in many different shades and patterns with bedford cord and cloth upholstering. The side seats and back are finished in the same quality and workmanship as the cushions. In the sedan, limousine and coupé the carpet matches the upholstering. The front seats are divided and shaped to fit the back.

Windshield Is Adjustable

One of the features of the equipment is the windshield, which is a special adjustable type designed to fit snugly to the body. There is an overlapping portion of the upper glass which shuts out rain and snow. The steering wheel is 18 in. in diameter, and some of the additional equipment includes the leather covered instrument board, Stewart-Warner magnetic speedometer, battery indicator, oil pressure gage, carbureter control, gasoline gage on rear tank, Yale switch lock, Sparton horn and complete set of tools.

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Pocket Book on Gearing

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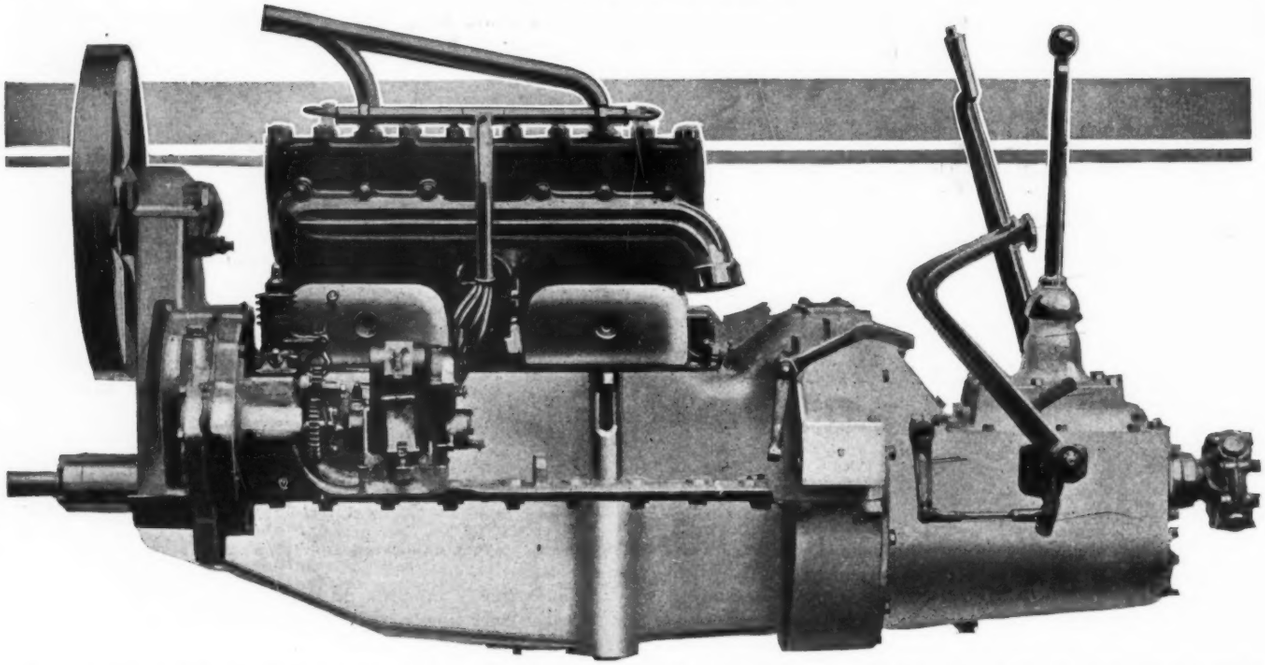
MANY useful tables and much data relating to gearing is contained in a little booklet issued by the Van Dorn & Dutton Co., gear specialists of Cleveland, Ohio, which they will be pleased to send to any engineer who will write them for a copy. Circular pitch, diametral pitch and metric pitches are all dealt with and there are long tables of conversion from diametral to circular giving the thickness of tooth, depth of cut, etc.: Formulas for strength of teeth and general information concerning bevel and spiral gearing are included.



Exhaust side of the new sixteen-valve, four-cylinder unit power plant which is a feature of the 1917 White. Note power tire pump mounting and magneto drive as well as inclosed fan drive

White Four Has Sixteen Valves

Two Wheelbase Lengths Provided on Otherwise Identical Chassis—Valves Are Set at an Angle

(*Continued from page* 949)

and in the experimental laboratory regarding the necessity for having the highest possible volumetric efficiency have been applied. As pointed out in the recent engine review in THE AUTOMOBILE, throughout the entire industry the motor engineers have realized that the way to success along the lines of thermal and mechanical engine efficiency is by securing the closest possible approach to 100 per cent filling on the intake stroke. The White company sums up the situation in the words, "valve efficiency is more important than the number of cylinders," and has used the sixteen-valve design to attain this end.

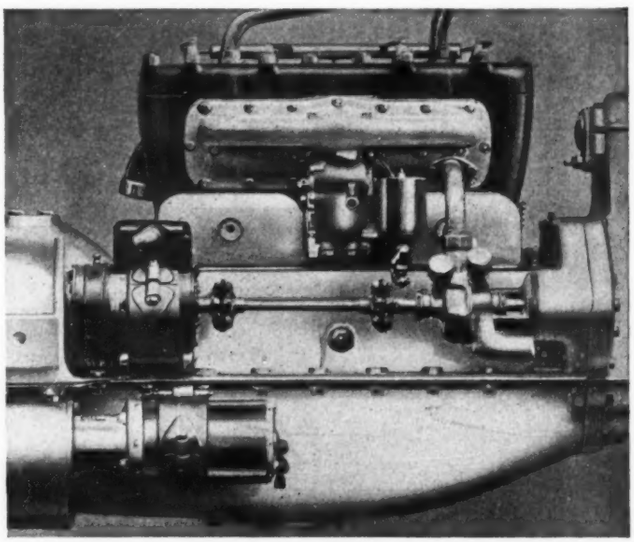
The White company advances nine reasons for the choice of the sixteen valve four. These are:

1—Greater volumetric efficiency.
2—Smaller valves for the same area.
3—Longer duration of maximum gas flow.
4—Cleaner scavenging.
5—Reduction of carbon deposit.
6—Reduction in number of times tuning is necessary.
7—Easiest course of gas flow.
8—Elimination of dead gas pockets.
9—Minimum area of combustion chamber wall.

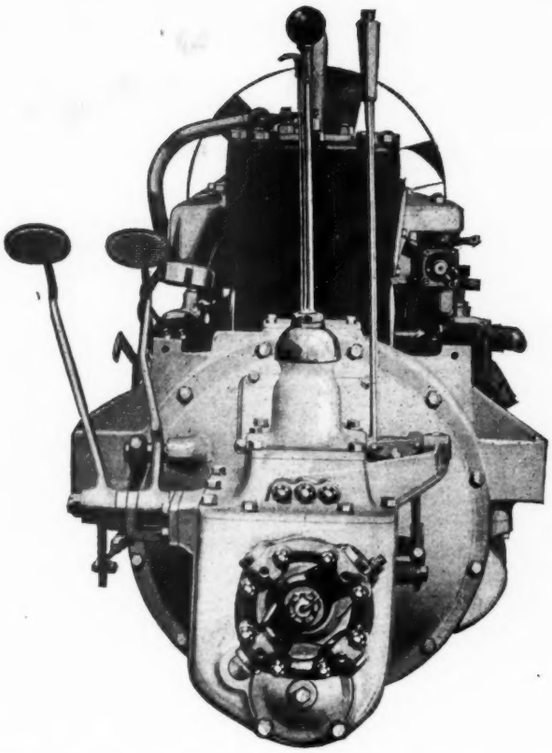
The chassis is made in two wheelbase lengths of 137½ in. for the touring, limousine and landaulet and 124½ in. for the runabout, sedan and coupé. With the exception of the wheelbases the two chassis are identical.

The Unit Power Plant

Combined as a single member, the engine, clutch and gearset form a unit power plant with three-point suspension. The 4¼ by 5¾-in. T-head cylinders are cast in a single block with the valves located at the four-corners of the square about the cylinder circle in the plan view. The cylinders are cast with an open arch between the second and third or middle two cylinders, for lightness this also serving as a factor in preheating the carbureter air. The head casting is entirely separate and contains no valve plugs, an unusual fact in conjunction with a T-head engine. The spark plugs



Intake side of the new White engine, showing mounting of carbureter and electrical units



Rear end view of the White sixteen-valve unit power plant, showing forward universal and control member mounting

are screwed directly through the head and fall in the diametric center of the cylinder, thus giving a symmetrical area for flame propagation and freedom from gas pockets. When the head casting is removed by taking out about fourteen studs, the spark plugs come off with it.

Removing the head exposes the valves and the combustion chambers, rendering the former free for grinding and the latter for cleaning. It takes 15 min. to remove the head and about 5 min. to take off all the side cover plates for the valves, to get at the springs and adjusting nuts.

The piston and rod assemblies are what would normally be expected in a high-speed engine of these dimensions. The pistons are aluminum alloy with three rings and other reciprocating weights have been kept low. The rods are drop-forged I-beams, and the crankshaft is carried on three main bearings which are lined with die-cast babbitt. The shaft is put into running balance by a series of counterweights.

There are two independent camshafts each carrying eight cams. These are driven by helical gears off the crankshaft, the timing gears being located in an independent case at the forward end of the crankcase. Stiffness is a feature of the camshaft to take the torsional stress of the eight valve springs, and the shaft is supported in five bushed bearings.

Valves Are Set at an Angle

A feature of the valves is that they are set on an angle to the vertical center plane. The principal reason for this being that it reduces the size of the combustion space and allows ample water space round the valves. Lubrication is by the full pressure system without splash. The pump is a gear design which leads the oil under a varying pressure commensurate with the speed of the engine to the main bearings. The shaft is hollow and the crank cheeks are also drilled, leading the oil directly to the lower rod bearings under pressure. The pistons and the cylinders are taken care of by the spray from the cranks and the oil then returns through a double bottom strainer to the aluminum crankcase reservoir in the bottom of the crankcase. All the bearings are carried in the upper half of the crankcase, so that when the pan is dropped the main and lower rod bearings are accessible for adjustment. By dropping the pan and removing the lower rod bearing caps the piston and connecting-rod assemblies can be withdrawn through the top of the cylinder, thus eliminating the necessity for removing the cylinder block.

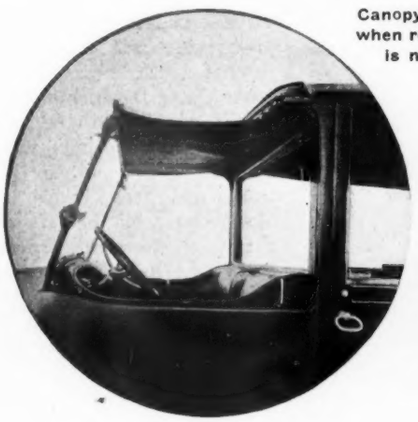
There is a level gage on the side of the crankcase, operated by a float which keeps the driver informed as to the oil supply. The condition of the feed is determined by the pressure gage. Former White cars have carried the oil supply in a dash reservoir. In keeping with the accessible design of the engine there is a removable plate through which the strainer can be taken from the crankcase and cleaned, and there is also a hand hole which allows of access to the inside of the case.

Vacuum feed is used for the gasoline system, the tank being mounted at the rear. The carbureter is a White barrel type of throttle bolted to a new design of intake. There is no header between the carbureter and the intake manifold to which it is attachd by a horizontal flange, the hot air passes through the arch in the center of the cylinder casting with a new type of adjustable stove attached to the exhaust pipe.

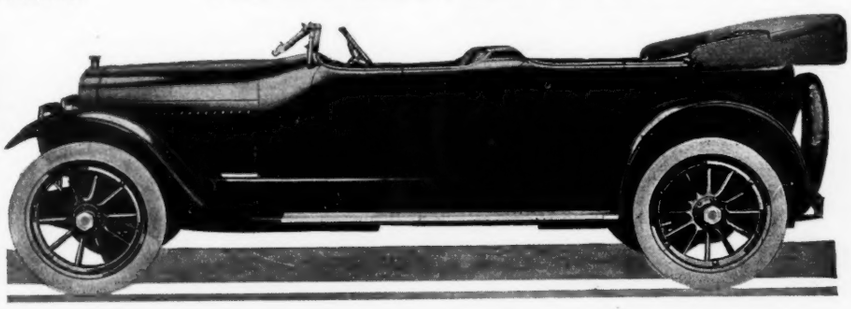
Provision for Heavy Fuel

As considerable attention is being paid to the heavier grades of fuel, the stove is of interest. There is a shutter valve on this, the air thus admitted being much cooler than that which enters the slot directly in the stove. The more the shutter is opened the greater the supply of cool air admitted, and the adjustment naturally depends on the atmospheric temperature. An accessible feature on this adaptation of the White carbureter is that both nozzles can be removed as a unit for cleaning by taking out two exterior bolts. The only adjustment on the carbureter is a knurled nut which governs the proportions of the mixture.

Pump circulation is used for the cooling water, with the pump on the generator shaft. The fan is a built-up alu-



Canopy for use when roof extension is not carried



White 1917 seven-passenger touring car which is fitted with the new sixteen-valve four-cylinder unit power plant. It sells for $4,600

minum unit with six blades and is driven by silent chain, the latter being inclosed. Adjustment of the fan drive is secured by placing the fan sprocket on an eccentric unit which is turned by a rack and pinion housed in the chain case. There is a nut connected with the pinion outside the case and when this is turned the adjustment is made by altering the center distance between the fan sprockets.

Two-Unit Electric System

For lighting and starting the Leece-Neville two-unit system is used and for ignition there is a single high-tension magneto. The generator is bolted to the crankcase at the right rear end, between the pump and generator, which are on the same shaft, there are two flexible couplings. The junction box is directly on the top of the generator.

Bendix gear connection is used between the electric starting motor and the flywheel ring gear. Current is supplied by a 12-volt, 75-amp. Willard or Exide storage battery, this voltage being used throughout all the circuits, and the two-wire system is employed.

A single plate, fabric-faced clutch running in oil is used. This delivers the power to a White four-speed gearbox which is over-geared on fourth. The shift is redesigned and, for the first time, the White company is using the cane type. The shifter is mounted on the cover of the gearbox following usual unit power plant practice. The gearset is carried on ball bearings and there is a removable plate at the bottom of the box through which the layshaft may be withdrawn, saving an hour at least on a repair job at this point.

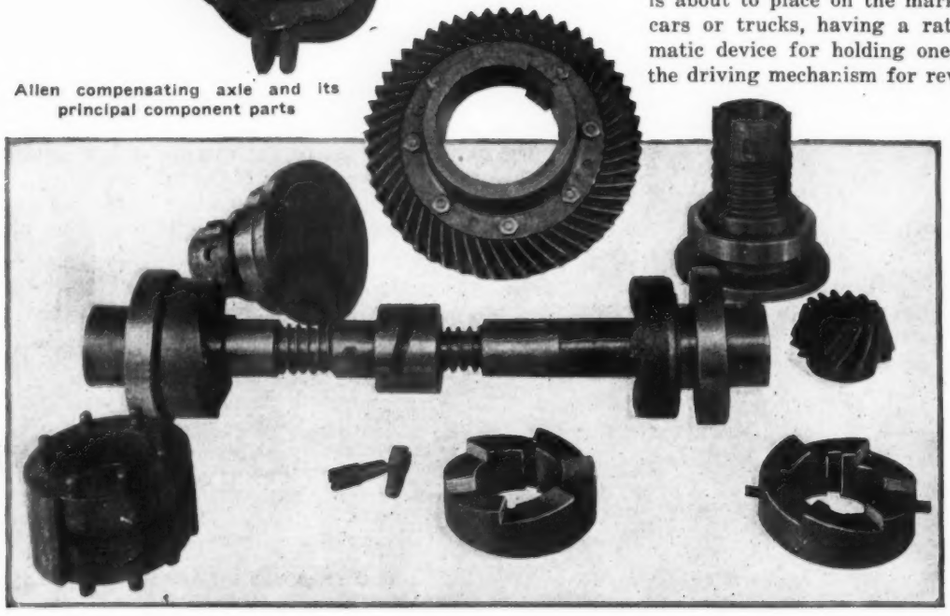
Hotchkiss Drive Used

Two universals and a telescopic joint are used in the drive to the semi-floating rear axle and the hollow shaft is of chrome nickel tube. Both torque and drive are taken through the 60-in. semi-elliptic springs which are underslung beneath the rear axle. The drive connection is at the front end of the spring. There is a kick-up in the rear of the pressed steel channel frame. The brakes are on the rear wheels and the tire size is 37 by 5-in. all around with Goodyear and Goodrich cord tires optional. The extra tires are carried in the rear on forged brackets bolted to the frame and an extra rim is furnished as regular equipment. Steering is by worm and sector.

All the bodies mounted on the sixteen-valve four-cylinder chassis are new. The touring car is a center cowl divided front seat design with sloping windshield. A handy point is the mounting of all the switches and the carbureter control on the steering column. The color finish is optional within limits and there is a new design of one-person top which the White company calls the Mono-top. Full equipment including a power-driven tire pump is included in the purchase price, which for the touring car is $4,600.

Clutch Drives in Allen Axle

Differential Replaced by Ratchet Clutches —Drive on Inner Wheel on Turns



Allen compensating axle and its principal component parts

IF it were not for the necessity for providing a reverse gear, a very good automobile axle could be made by simply driving the two road wheels through ratchet clutches, so that the outer wheel on a turn would over-run the inner wheel, the latter doing all the driving. Such an axle, however, would not permit of reversing, and the engine would not be driven by the car in coasting, making it impossible to take advantage of the engine friction to provide braking effect.

The Allen Compensating Axle Mfg. Co., Philadelphia, Pa., is about to place on the market a new design for passenger cars or trucks, having a ratchet drive and a simple automatic device for holding one of the rear wheels rigidly to the driving mechanism for reversing or when the axle drives the engine.

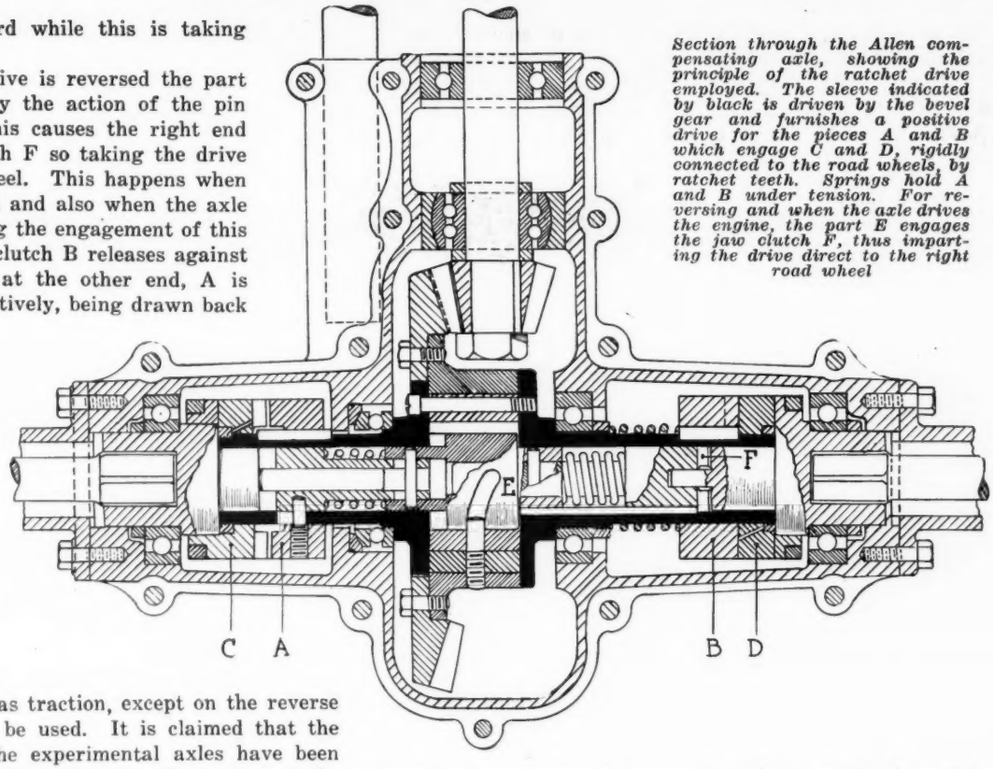
In the sectional view the sleeve shown in black is driven by the bevel gear and drives positively the two pieces A and B having ratchet teeth engaging the parts C and D which are connected rigidly to the road wheels. The springs which hold A and B up to their work are seen inside the black sleeve on the left and outside on the right. In forward driving the springs keep the ratchets engaged, but when a turn is made the outer road wheel over-runs the clutch on that side releasing against its spring. It is stated that the click of

the ratchet cannot be heard while this is taking place.

When the direction of drive is reversed the part E is moved to the right by the action of the pin and helical slot shown. This causes the right end of E to engage a jaw clutch F so taking the drive direct to the right road wheel. This happens when the reverse gear is engaged and also when the axle over-runs the engine. During the engagement of this reverse clutch the forward clutch B releases against its spring, but the clutch at the other end, A is held out of engagement positively, being drawn back by the movement of E as can easily be seen by following the details of the drawing.

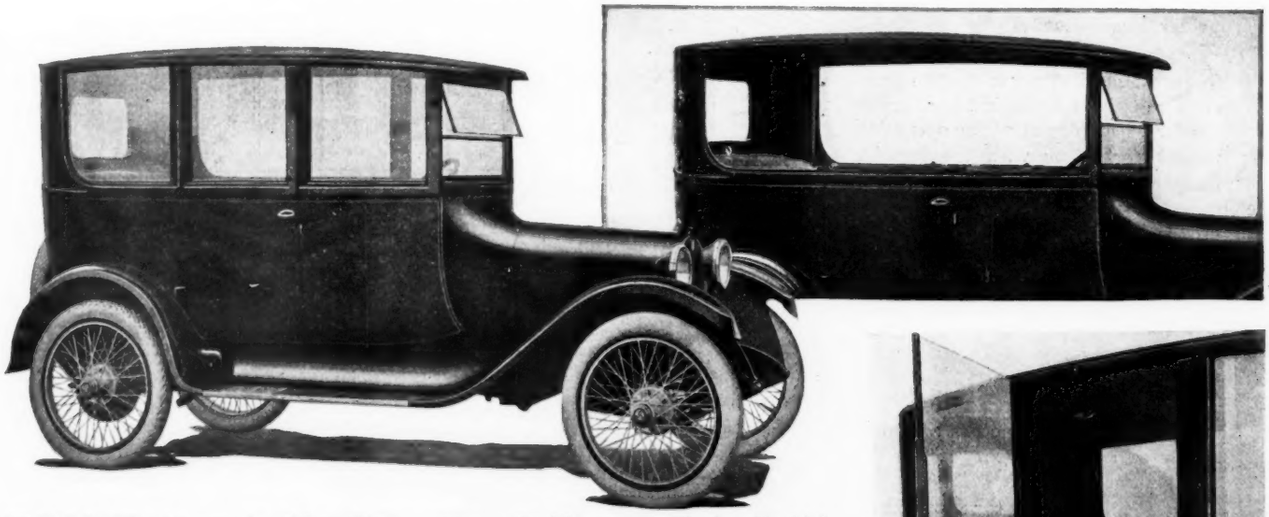
As soon as forward drive recommences the movement of the pin in the helical slot releases the reverse clutch and allows the main clutches to operate as before.

With this axle it is not possible to spin a wheel that loses traction, so there is always driving power for the wheel that has traction, except on the reverse where only one wheel can be used. It is claimed that the extensive tests to which the experimental axles have been put on heavy touring cars show that the elimination of the usual differential reduces the tendency to skid on applying brakes almost to vanishing point, since locking one brake cannot put a reverse drive on the other. It is planned to produce the Allen axle as a replacement part for several of the popular cars and also as a manufacturing proposition.



Section through the Allen compensating axle, showing the principle of the ratchet drive employed. The sleeve indicated by black is driven by the bevel gear and furnishes a positive drive for the pieces A and B which engage C and D, rigidly connected to the road wheels, by ratchet teeth. Springs hold A and B under tension. For reversing and when the axle drives the engine, the part E engages the jaw clutch F, thus imparting the drive direct to the right road wheel

Elegance in New Dodge Convertible Sedan



DESIGNED for use in either Summer or Winter, the new convertible sedan brought out by Dodge Bros., Detroit, is marked by conservative lines in which the influence of the latest American and European body styles is evident. The color scheme of the interior is gray with a bluish tint, a striped effect being carried out in the upholstery, curtains and flexible robe cords, with carpet, front compartment floor and running board coverings also gray. Cushions are of the Turkish type, upholstered in gray and trimmed with narrow lace. All fittings are nickel fitted and there is flush dome light. The front seats are divided.

The rear side windows may be removed and concealed in a narrow compartment in the back of the rear cushion. The other windows lower out of sight and the pillars may be carried under the rear seat. The sedan sells for $1,185, f.o.b. Detroit.

Four-Cylinder Best Tractor Engine

Tests of a Number of Engines Show Great Variations in Performance—Valve Timing Varies Greatly

By A. A. Potter and W. A. Buck

THE following gives the gist of an interesting account of investigations into the efficiency of tractor engines, and is extracted from a paper presented at the December meeting of the A. S. M. E. While many other engineers may not agree with the authors' conclusions, they have compiled their data carefully and the tables give information that cannot fail to be of value to tractor-engine manufacturers.

Authors' Conclusions

From the results of this investigation the authors have derived the following general conclusions:

The four-cylinder motor is better adapted for belt work on account of the greater number of impulses per revolution.

The single-cylinder motor and the two-cylinder motor operate better than the four-cylinder motor with fuels heavier than gasoline.

Carbureter Requirements

Carbureters now used are satisfactory for gasoline, but a carbureter jacketed with heat from exhaust gases should be employed when operating with kerosene or with the heavier fuels.

The ordinary automobile motor is too light for traction-engine work. The traction-engine motor should operate at lower piston speeds than the automobile motor. Motors operating at piston speeds of 700 to 900 ft. per minute are giving satisfaction.

Vertical Engines Preferable

The vertical types of motors are preferable on account of longer life and greater accessibility.

The valve-in-the-head type of motor has the more efficient combustion space and is to be preferred to the T-head or L-head types.

The combination of the forced feed and splash oiling system gives good results.

Jump Spark Ignition

The jump-spark system, on account of its mechanical simplicity, is the best system of ignition for traction engines of more than one cylinder.

The fuel-economy range is from about 1.30 lb. per brake horsepower per hour at one-fourth load to about 0.7 lb. per hour at full load. The fuel consumption in pounds per brake horsepower per hour is very nearly the same for both gasoline and kerosene.

Thermal Efficiencies

The thermal efficiencies at full load vary from 14.88 to 19.8 per cent for gasoline fuel, and from 13.7 to 15.97 per cent for kerosene.

The results of the tests relating to fuel consumption and thermal efficiency are given in Table 2. The lower fuel economy of the tests recorded for engine A as compared with tests on engine B (the same engine) was due to the difference in the spark advance. During the operation of engine A a greater spark advance was used, and more cooling water had to be injected into the cylinder with the fuel to prevent preignition. Water injection had to be used also during the tests of several engines with gasoline fuel (engines D, E and F).

Table 2. Fuel Consumption and Thermal Efficiency of the Traction-Engine Motors Tested

Engine	Per Cent of Full Load	Fuel per Hour per Shaft, Hp., Lb.	Thermal Efficiency, per Cent
A (60 B.H.P.) (Kerosene)	57.8	0.963	13.43
	99.8	0.808	15.88
	70.8	1.032	12.53
	38.2	1.683	7.67
	111.3	0.928	13.93
	98.8	0.874	14.77
	70.4	0.996	12.97
	41.5	1.188	10.88
	23.0	2.154	6.01
B (60 B.H.P.) (Kerosene)	18.1	1.780	7.26
	48.9	1.480	8.74
	17.5	1.750	7.39
	33.5	1.460	8.86
	51.1	1.100	11.76
	51.9	1.230	10.52
	84.8	0.780	16.58
	66.4	0.990	13.07
	65.9	0.760	17.00
	84.6	1.090	12.87
	97.8	0.810	15.97
	104.3	0.980	13.19
	127.8	0.940	13.76
C (65 B.H.P.) (Gasoline)	28.1	1.227	10.53
	65.1	0.793	16.34
	66.4	0.874	14.82
	100.6	0.731	17.73
	102.1	0.767	16.89
	112.7	1.010	12.83
	27.5	1.382	9.38
C (65 B.H.P.) (Kerosene)	68.1	1.008	10.06
	67.8	1.010	12.95
	101.8	0.910	14.36
	36.0	1.582	8.26
	101.3	1.328	9.83
	102.9	1.292	11.63
	102.9	1.274	10.24
D (50 B.H.P.) (Gasoline)	90.0	0.997	13.43
	94.4	0.899	14.88
	74.8	0.820	16.33
	52.6	0.883	15.17
E (50 B.H.P.) (Gasoline)	23.0	1.413	10.10
	23.6	1.204	11.87
	47.1	0.670	21.32
	48.8	0.720	19.80
	73.2	0.710	20.10
	74.0	0.710	20.10
	90.6	0.740	19.41
F (40 B.H.P.) (Gasoline)	8.7	3.210	3.85
	32.7	1.140	10.34
	32.7	1.120	12.36
	43.6	1.130	11.22
	43.2	0.950	13.02
	43.9	0.980	12.54
	64.7	0.808	15.28
	66.2	0.750	16.47
	88.0	0.730	16.94
	86.0	0.890	13.90
	82.4	0.780	15.25
	83.7	0.770	16.06
	84.0	0.770	16.06
G (35 B.H.P.) (Gasoline)	105.3	0.643	19.80
	127.0	1.047	12.10
	107.0	0.736	17.30
	98.5	0.706	18.00
	81.6	0.779	16.30
	50.3	1.030	12.40
	24.0	1.690	7.50
	80.6	1.045	12.20
	98.8	0.685	18.60
	81.8	0.808	15.80
	52.0	1.025	12.40
	23.6	1.791	7.10
H (25 B.H.P.) (Kerosene)	113.0	0.800	15.97
	131.2	1.019	12.54
	92.1	1.042	12.27
	58.1	1.161	11.02
	28.7	2.097	6.10
	110.7	0.794	16.08
	121.7	0.794	16.08
	91.4	0.951	13.45
	57.9	1.230	10.40
	27.2	2.099	6.09
	132.8	0.989	12.93
	91.9	0.930	13.73
J (25 B.H.P.) (Gasoline)	78.8	0.950	13.70
	80.4	0.810	16.10
	86.8	0.930	13.90
	39.9	1.050	12.40
	24.4	1.640	7.90
	72.4	0.760	17.20
	73.2	0.680	19.20
	96.0	1.040	12.50
	93.5	1.060	12.20
	95.9	1.030	12.60
	98.9	0.730	17.80
	70.1	0.740	17.50
J	69.1	0.700	18.80
	49.4	0.860	15.10
	49.5	0.930	14.00
	37.2	1.540	8.40
K (20 B.H.P.) (Gasoline)	127.7	1.003	12.69
	66.4	1.178	10.80
	92.9	0.976	13.03
	34.1	1.638	7.77
	51.9	1.380	9.22
	75.8	1.071	11.87
	98.5	0.905	14.06
	36.9	1.948	6.37
	54.6	1.385	9.18
	75.7	1.043	12.20
	110.3	0.818	15.44
L (16 B.H.P.) (Kerosene)	73.4	0.865	9.71
	45.8	1.447	9.12
	99.8	1.330	9.92
	23.3	1.778	7.42
	48.8	1.108	11.92
	72.1	1.020	12.93
	103.3	1.248	10.57
	23.2	1.865	7.07
	70.8	1.303	10.13
	98.2	1.003	13.17
	104.4	0.936	14.10
	71.5	1.279	10.32
	70.4	1.185	11.28
	44.8	1.187	11.22
	22.7	1.929	6.84
M (20 B.H.P.) (Gasoline)	71.1	1.103	11.97
	101.3	1.007	13.11
	93.0	1.043	12.64
	45.3	1.103	11.97
	22.9	1.702	7.76
	79.5	0.884	14.20
	30.5	1.508	8.30
	84.2	0.913	13.20
	18.9	1.753	7.20
	56.8	1.153	10.90
	87.2	1.103	11.40
	60.1	1.020	12.30
	104.1	0.811	15.40
	104.3	0.803	15.60
	60.5	1.103	11.40
	79.2	0.908	13.80
	77.8	1.051	11.90
	41.2	1.428	8.80

Table 1. Particulars of the Traction-Engine Motors Tested and the Fuels Used

Engine	Type (all 4-stroke cycle)	Ignition System	Lubrication System	Carburetor	Cooling System	Governor	Fuel: Gasoline or Kerosene	Fuel: Specific Gravity	Fuel: Heating Value, B.t.u. per Lb.	Rating, B.h.p.	Bore, In.	Stroke, In.	Rev. per Min.
A	hor., twin, 2-cyl.[1]	high-tension[7]	mech. op. sight-feed oilers	.....	pump	throttling[2]	K	0.809	19,700	60	....	....	.....
B	(same motor as A,	but tested when ne	w)	.....	.....	.....	K	0.800	19,680	0	....	....	.....
C	vert., L-head, 4-cyl.[1]	high-tension[3]	splash and mech. op. sight feed	Bennett	pump	throttling[2]	G	0.739	19,670	65	7¼	9	500
							K	0.786	19,500				
D	vert., T-head, 4-cyl.[1]	high-tension[3]	sight-feed pump	Bennett	pump	diaphragm[4]	G	0.741	19,000	50	6	7	650
E	hor., opposed, 4-cyl.[1]	high-tension[3]	st.-feed pump splash	Kingston	thermo-syphon	throttling[2]	G	0.735	17,880	50	6½	7	500
F	hor., opposed, 2-cyl.[1]	dual	mech. st.-feed oiler	Rayfield	thermo-syphon	throttling[2]	G	0.730	20,600	40	8	9	350
G	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[2]	G	0.737	20,000	35	5	7	700
H	hor., L-head, 4-cyl.[1]	high-tension[3]	mech. st.-feed oiler	.....	pump	throttling[2]	K	0.789	19,900	25	5¼	8	575
J	hor., opposed, 2-cyl.[1]	high-tension[3]	pump splash	Kingston	thermo-syphon	throttling[2]	G	0.747	19,550	25	6½	7	570
K	vert., L-head, 4-cyl.[1]	high-tension[3]	pump splash	Bennett	pump	throttling[2]	G	0.737	20,000	20	4¼	5¾	800
L	hor., single-cyl.[1,5]	low-tension[6]	sight-feed oiler	.....	hopper	throttling[2]	K	0.805	19,280	16	8	12	400
M	hor. L-hd., 2-cyl., opp.[1]	Kingston dual high-tension	mech. st.-feed oiler	Kingston	pump	throttling[2]	G	0.738	20,290	20	5¼	7	650–720

[1]With mechanically operated inlet and exhaust valves.
[2]High-speed throttling type of governor that regulates the quantity of mixture.
[3]With K-W impulse starter magneto.
[4]Diaphragm type, using pressure of circulating water to control the speed.
[5]Valve in the head.
[6]Make-and-break system using an Accurate oscillating magneto.
[7]High frequency belt driven K-W magneto with trembler coil.

In the case of several engines the valve setting had to be changed before satisfactory operating conditions could be secured. In one case the preliminary tests indicated that the carbureter was too small for the engine. In order to facilitate comparison of various types the motors of the tests were grouped as follows:

Group I—Motors which develop at full load 15 to 26 hp. on brake. The tests recorded for motors H, J, K, L and M are included in this group.

Group II—Motors which develop 26 to 51 b.hp. In this group belong the motors recorded in the tables as D, E, F and G.

Group III—Motors which develop more than 51 b.hp. The tests recorded for motors A, B and C represent this group.

Average Fuel Economy

The average fuel economy for the various groups appears in the table at the right.

From the data on Group I and Group III Table 3 has been computed. Computations could not be made for Group II, as the engines in this class were not operated on kerosene. Table 3 shows the advantages of the kerosene-burning engine. Considering Group I, 10.07 gal. of kerosene will deliver as much power as 10 gal. of gasoline. With kerosene at 10 cents per gallon and gasoline at 20 cents, the cost with gasoline fuel will be 1.99 times that with kerosene fuel for the same power developed. Considering Group III, 12.32 gal. of kerosene will deliver as much power as 10 gal. of gasoline. This gives a ratio of 1.62 to 1 with prices of fuel at 10 cents per gallon for kerosene and 20 cents for gasoline. The advantages of the kerosene engine are offset to a greater or less degree, depending upon the operator, by the added trouble in handling. The life of the motor will also be somewhat shortened when using kerosene fuel. To this should be added the lower reliability with the heavier fuel. In some work done by traction engines reliability is the main factor.

Valve Timing

A study of the valve timing of the different motors in these tests shows no uniformity, except that the majority of the motors are so timed that the inlet valve does not open until after the exhaust valve is closed. The timing given in Table 4 is offered as a result of the authors' study and experience with traction engines.

TABLE SHOWING AVERAGE FUEL ECONOMY FOR THREE MOTOR GROUPS

Per Cent of Full Load	Fuel Consumption, Lb. per B.H.P. per Hour: Gasoline	Kerosene	Gasoline	Gasoline	Kerosene
Group	I	I	II	III	III
25	1.853	1.990	1.416	1.47	1.827
50	1.147	1.265	0.893	0.93	1.190
75	0.940	1.044	0.767	0.78	1.013
100	0.855	0.935	0.720	0.73	0.977

TABLE 3—COST OF TRACTION-ENGINE POWER WITH GASOLINE AND KEROSENE

Per Cent Load	Cost per Horsepower-Hour in Cents with 60° Baumé Gasoline at Prices per Gallons (in Cents) of: 9	12	15	18	21	45° Baumé Kerosene at Prices per Gallon (in Cents) of: 5	7	9	11
25	2.72	3.62	4.53	5.43	6.34	1.49	2.10	2.70	3.30
50	1.68	2.24	2.80	3.36	3.93	0.95	1.33	1.71	2.09
75	1.38	1.83	2.30	2.75	3.22	0.78	1.10	1.41	1.71
100	1.25	1.67	2.09	2.51	2.93	0.70	0.98	1.26	1.54
Group III									
25	2.16	2.88	3.59	4.31	5.03	1.37	1.92	2.47	3.02
50	1.37	1.82	2.27	2.78	3.18	0.89	1.25	1.61	1.97
75	1.14	1.53	1.90	2.29	2.67	0.76	1.06	1.37	1.67
100	1.07	1.43	1.78	2.14	2.50	0.73	1.03	1.32	1.61

TABLE 4—VALVE TIMING FOR MOTORS OF TRACTION ENGINES

Speed of Motor, r.p.m.	Exhaust Valve: Opens before outer center	Exhaust Valve: Closes after inner center	Inlet Valve: Opens after inner center	Inlet Valve: Closes after outer center
200	20° to 25°	0° to 3°	0° to 3°	15° to 20°
300	22° to 27°	0° to 5°	2° to 5°	15° to 20°
400	27° to 32°	2° to 5°	2° to 7°	15° to 20°
500	30° to 35°	4° to 8°	5° to 10°	18° to 23°
600	35° to 40°	4° to 8°	8° to 12°	18° to 23°
700	40° to 45°	6° to 10°	10° to 12°	20° to 25°
800	45° to 50°	6° to 10°	10° to 12°	20° to 25°

Should Study Car Balance

Roadworthiness Equivalent of Seaworthiness and Different from Roadability—Proper Distribution of Weight on Front and Rear Axles Vital

By "Mercury"

WHEN a naval architect undertakes the design of a vessel, he must know accurately the weight and position of every bit of material which will enter into the construction. The sum of the weights must be exactly the displacement on which he has figured, to bring the ship to the water line he has laid down; they must be equally disposed on each side of the center line, so that she will float on an even keel; they must be properly distributed fore and aft, so that she may ride easily on the waves. Too much weight in the bow or the stern will make her steer wildly or plunge heavily into the seas; a lateral concentration of the weight will cause her to roll violently; while if her center of gravity is too high, she may be in danger of being rolled over by a beam sea, a menace to the lives of her crew and the safety of her cargo. In every part, the exact distribution of the weight must conform to the rules of science or the dictates of judgment and experience.

Weight Distribution

So this question of weight distribution has become as much a part of the work of those who design the carriers of the sea, as the determination of form, power and strength. In the design of the carriers of the land, it has received considerably less attention, although there seems to be little doubt that, as the distribution of weight in a ship affects the seaworthiness of the vessel, so the distribution of weight in an automobile affects its "roadworthiness." Perhaps some of this lack of attention may be explained by the fact that while water is a yielding medium which quickly makes apparent any defects in the distribution of the weights, the automobile rests on a solid base, and defects of this nature are not so readily discoverable. Perhaps also, "roadworthiness" is such an indefinable thing that it is difficult to formulate any rules in regard to it.

On the other hand, seaworthiness is also an indefinable thing, but although its attainment was for centuries, and still is, largely a matter for judgment and experience, nevertheless, many logical thories and some exact rules have been produced that have well-nigh revolutionized the art of ship design. While we can hardly expect theories and rules to be propounded within a few years, which in a similar case have required centuries for their production, nevertheless so many and such active minds have in recent years been concentrated upon automobile design and so much energy and wealth have been devoted to the attainment of perfection in automobiles, that it seems remarkable that more serious attention has not been given to this particular subject of the distribution of weight.

Old Models Often Superior

Many of our latest and most up-to-date designs suffer from this lack of attention, which is made only more apparent by their high degree of refinement in other directions. The ability to attain a high speed is a very useless accomplishment if that speed can only be attained on a road like a billiard table. Many a fine modern car that runs with the silence of an electric motor and that will show a fine turn of speed on the testing track, is put to shame on the road by some lumbering old Simplex or Fiat that rolls past, into the ditch and out again, with hardly a tremor, maintaining over all kinds of road surfaces a speed which the other would not dare to attempt. A plain board seat on a well balanced car may be more comfortable than the most luxurious upholstery on a car that bounces all over the road.

This is not entirely a matter of springs, as many people seem to think. One car that I have in mind, although very well sprung, is often at a disadvantage simply on account of the excessive weight of its rear axle. Another very popular car is a positive menace to its occupants and to other road users because of the high position of its center of gravity, and I have personally witnessed serious accidents which were attributable solely to this defect. Again, many chassis are entirely satisfactory when fitted with heavy touring or limousine bodies, but buck like bronchos when equipped as runabouts, while some touring cars that are quite comfortable with their full complement of passengers are very uncomfortable with only the front seats occupied.

Among the many advantages of the multi-cylinder V-shaped engines, their compactness has often been cited, but it is also a fact that the great weight of the engine concentrated so far forward in the chassis has caused, in some cases, cars fitted with this type of engine to steer very wildly at high speed. Instances could be multiplied where "roadability" has been obtained at the expense of "roadworthiness." It is said that before the last British Tourist Trophy race, a competitor who had a very light car with a very heavy engine, arranged the engine to be movable, and by successive trials found the position of the engine in the chassis which would allow his car to maintain its best speed under the very varying conditions of the roads in the Isle of Man.

General Rules Possible

These instances simply point to the importance of this subject. While, of course, the wide variations in detail design make impossible an absolute standardization of the weight and position of each unit which enters into the construction, nevertheless it would appear that some general rules could be laid down for the position of the center of gravity, of the whole car, for the proportions which the weights of the various units should bear to one another and to the weight of the car as a whole and for the positions of these weights with respect to the center of gravity, to obtain the best balance and most satisfactory performance. Such an apparently elemental question as the proportion of the total weight which it is advisable to carry on the rear wheels is far from answered in the minds of most of us, and yet experience can readily supply a figure, which if not an inflexible rule, represents at least a satisfactory solution.

Years ago, the designer of the famous Lanchester cars, to whom we owe the introduction of the worm-drive and the wire wheel on modern cars, aroused considerable controversy by his original views on the proper distribution of weight, but since that time so little has been added to his investigations, that I think it would be extremely interesting, as well as instructive to many of us, to have the opinions both of designers and of users on this subject.

The Rostrum

Has 1905 Overhead Valve Peerless

EDITOR THE AUTOMOBILE:—I have an old four-cylinder overhead valve Peerless, No. 915, type 11. Can you tell me about what year it was made?

2—What is the gear ratio in fourth?

'—What is the horsepower rating and the r.p.m. of the engine?

4—What is the displacement of the pistons? E. A. F.

Philadelphia, Pa.

—This car was produced during the season of 1905.

2—The total gear reduction on fourth speed, which is direct drive, is 4 2/7. The maximum gear speed would, of course, be very difficult to determine on a car as old as this without some knowledge of its present condition.

3—Approximately 34 hp. figured at 1000 ft. piston speed, or roughly 1100 r.p.m.

4—The piston displacement is about 369 cu. in.

Removing Tar from Car Bodies

Editor THE AUTOMOBILE:—Supplementing my previous communication with reference to removing tar from automobile bodies, as it is a fact because tars are readily soluble in raw linseed oil, it is only necessary to apply the oil thoroughly in order to dissolve the pitch, and any convenient method of applying the oil that will not scratch the painted surface will be found satisfactory.

Would suggest, however, that the painted surface first be washed so as to remove all grit, then after same is dried apply the linseed oil with a soft rag, gently removing the spots of tar or pitch, and they will dissolve and come away from the painted surface without damage to same. Then after the pitch has been thoroughly dissolved, so that the painted surface appears to be free from same, due to the combination with the oil, then apply the ordinary wash of soap and water to remove the oil. This practice will be found more satisfactory than any other method I have ever known and is very easy to apply. H. A. M.

Philadelphia, Pa.

Cannot Change Steamer to Gas Car

Editor THE AUTOMOBILE:—I have a model 0.0 White steamer which has been run about 7000 miles. Would it be advisable to change it into a gasoline car if a suitable engine could be bought? D. O. W.

Marshfield, Ore.

—It is not practical to change your steamer into a gasoline car. Many persons have tried to do so in spite of advice that it cannot be done with any degree of efficiency. You would need a new radiator, engine, clutch, transmission and rear axle, to say nothing of necessary changes in the frame. The axle is high geared and not the right type for a gasoline car.

Timing for Model 17 Buick

Editor THE AUTOMOBILE:—Kindly give valve timing for the model 17 Buick.

Marysville, Ohio. M. M. CAR CO.

—The valves for the model 17 Buick will be correctly timed when the exhaust valve closes when piston is 1/16 in. past its upper dead center position and inlet valve opens when piston is 3/32 in. past its upper dead center. These measurements should be taken with a clearance of 0.010 in. between ends of valve stems and rocker arms when both valves are fully closed.

Wiring Diagram of 1910 Pierce 48

Editor THE AUTOMOBILE:—Kindly give wiring diagram of a 1910 Pierce 48 connecting up the coil with the battery and commutator, the original outfit of the Pierce-Arrow being used. I have been starting on the magneto and would like to have the battery to start on for the winter. H. C.

Brooklyn, N. Y.

—Wiring diagram of 1910 Pierce 48 is illustrated in Fig. 1.

Avoid Stopping on Main Highway

Editor THE AUTOMOBILE:—A remarkable demonstration of the wisdom of adopting and constantly living up to the principle of Safety First was given an automobilist of East Orange, N. J., recently. By exercising a little forethought he no doubt saved his wife's life and placed her in a position to safeguard his. On the side of a new and quite slippery road near Millburn, N. J., this gentleman was busy placing chains on his automobile when the thought occurred to him

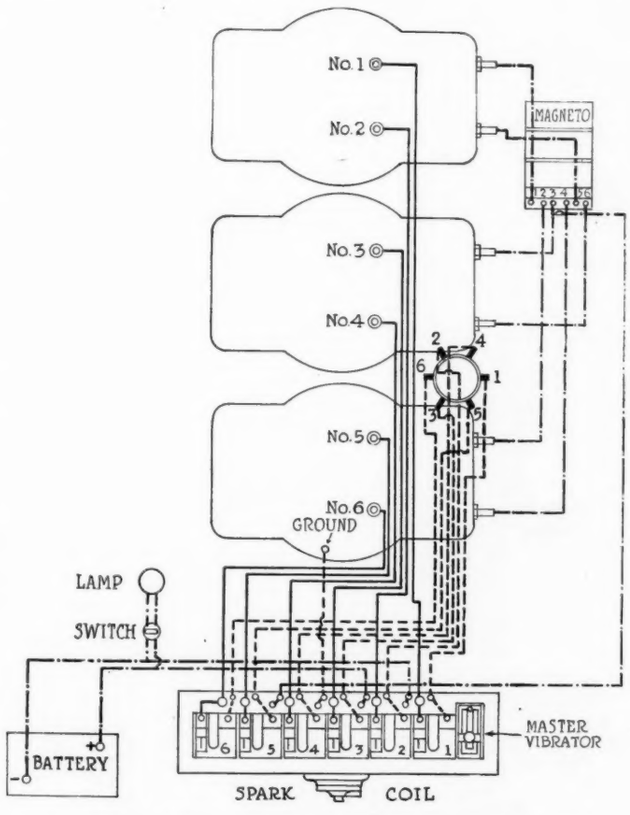


Fig. 1—Wiring diagram of 1910 Pierce-Arrow 48

that his wife, who was standing beside him, was in a dangerous position in the event of a car skidding into his.

Almost immediately after acting on his advice and stepping to the side of the car, a warning cry from her gave him sufficient time to step out of the way and avoid being struck by a large touring car which was skidding sideways and struck the rear end of his car with great force. The impact drove his car ahead, it afterward taking a course at right angles over an embankment down into a field.

This experience teaches automobilists that it is a very wise precaution and in obedience to the principle of Safety First to drive into a side street or roadway when conditions on main thoroughfares are dangerous and there stop for any needed purpose.

The fact that a part of your car is likely to stand in the way of passing cars making it necessary for the drivers to turn to one side, or possibly put on brakes, to allow traffic from opposite direction to pass—in either case inviting a skid—makes the above rule a wise one to follow.

East Orange, N. J. H. J. B.

How Delco Ignition System Operates

Editor THE AUTOMOBILE:—The Delco ignition on the 1916 Cadillac has been a puzzle to me for a long time. I have read instruction book as well as other books on it and still do not get it. Please tell me how the current travels from the battery to the plugs. Do the two breaker points break a primary circuit or does one break the primary and the other a secondary? Does the current come from the battery continuously even at high speeds or from the generator?

Brooklyn, N. Y. H. A. G.

—Current comes from the battery to each of the breakers. One breaker cares for one set of four cylinders and the other for the other set. No current is passing except when the one or other of the contacts is closed. When either pair of contact points come together the battery current passes through the primary winding of an induction coil. As soon as the points separate again the effect of stopping the flow of current suddenly like this is to cause a very high voltage current to be generated in the secondary winding of the induction coil. This high voltage current goes to the high tension distributer and this sends the discharge to the proper spark plug.

In an induction coil there is no connection between the primary and secondary coils. The former is a short coil of fairly thick wire, and outside this a great length of fine wire is wound. When current flowing through the inner coil is stopped a "surge" of high tension current is generated in the thin wire coil and the voltages are roughly in proportion to the lengths of wire in the respective coils.

At low speeds and at high speeds current is supplied by the generator, but it passes through the battery first. The battery is like a tank of water kept full all the time by a pump, the generator being the pump.

1910 Herreshoff Multiple-Disk Clutch

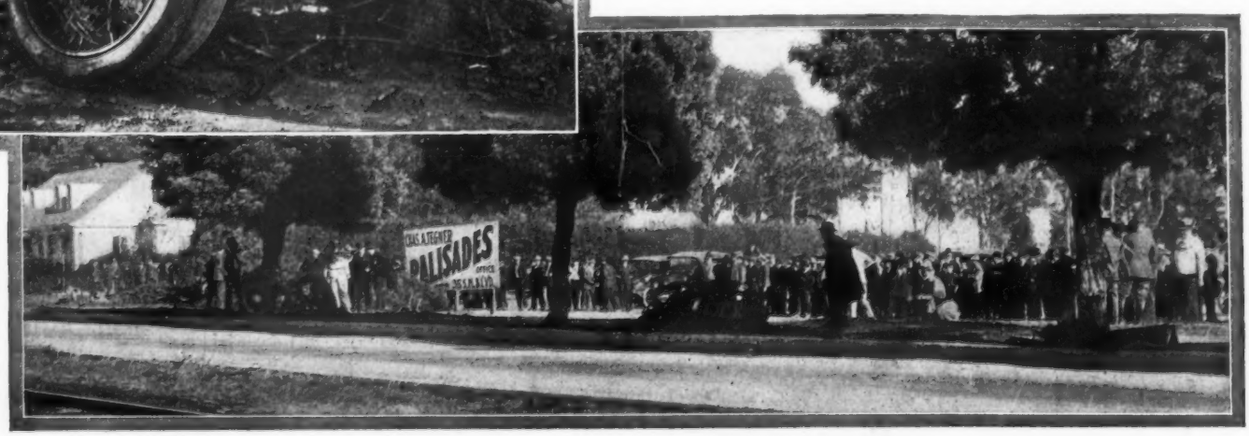
Editor THE AUTOMOBILE:—Will you kindly advise the number of disks in the multiple-disk clutch of the Herreshoff unit power plant in the 1910 or 1911 runabout? Also, please give the best timing for the engine. WM. M. L.

Paterson, N. J.

—There are fifteen driven and fifteen driving disks in the clutch of the Herreshoff 1910 and 1911 runabout. We are unable to furnish the timing of the motor.

A 2000-Hp. Crash at 100 M.P.H.

THE accompanying illustrations of Jackson's car wrecked in the thirteenth lap of the Grand Prize road race held at Santa Monica, Cal., Nov. 18, demonstrate the enormous amount of energy stored up in the rapidly moving car as well as the danger of modern high-speed racing cars traveling on ordinary streets and roadways. This machine was moving at 100 m.p.h. and probably weighed at least 3000 lb. It would then possess a kinetic energy of 1,007,390 ft.-lb. If this was dissipated in 1 sec. as the car struck the tree, work would be done at the rate of nearly 2000 hp. The force of the blow when the car hit the tree is equivalent to a blow from a weight of 1 ton falling freely for 500 ft.



The car hurdled the concrete curb, smashed two trees, one of which fell on a moving picture operator, killing him, and demolished a refreshment stand, killing the woman occupant and a spectator standing nearby. The car finished by wrapping itself around a third tree, cutting Jackson's body in two and hurling his mechanic, John Ghianda, 40 ft., seriously injuring him. Wreckage broke a woman spectator's arm and injured a man.

ACCESSORIES

Perry Lock Steering Wheel

BESIDES in a complete steering wheel for any car, Perry locks are supplied to be mounted under the steering wheel on Ford cars. As shown in the illustration, the complete steering wheel is a very neat construction, the locking mechanism, consisting of a hexagon and a hub which is rigidly keyed to the steering post, being integral with the spider hub. When the car is locked, a key being used, the steering wheel has no connection with the steering column and is free to spin like a top, but when the wheel is in the driving position it is securely engaged. Different keys are supplied for every lock.

The device for Fords consists of a collar containing a locking device on the same principle as that used in the complete wheel, the steering wheel being locked out of engagement with the column. When in driving position the wheel is held as rigidly as if the lock were not used. In installing the lock no change is necessary except the replacement of the gear housing directly under the steering wheel. This can be done by anyone in 15 min.

With either of these devices the car cannot be towed or driven away as the front wheels are out of control. Price of complete wheel is $15. Ford lock sells for $5, installed.—Perry Auto Lock Co., 1238 Michigan Avenue, Chicago.

Perry lock steering wheel

Perry lock for Ford cars in place on the steering column

Perry lock for Ford steering wheel

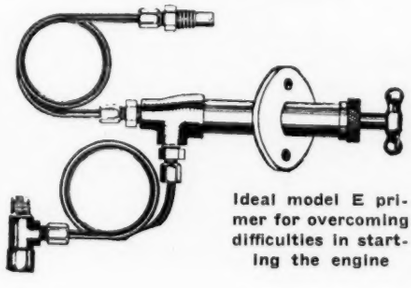
Marvel Spark Intensifier

As shown in the accompanying illustration, this device embodies the principle that forcing the current to leap a gap before reaching the spark plug intensifies the spark which occurs between the points of the plug. A glass case incloses the two electrodes and the width of the gap may be readily adjusted by a small nut outside the case. Adjustment of the points is facilitated by having the spark gap in the intensifier visible through the glass. One intensifier should be fitted to each plug. The devices are neatly finished and simple to attach. Price 75 cents each.—Marvel Mfg. Co., 1020 Washington Boulevard, Oak Park, Ill.

Marvel Spark Intensifier attached to plug

Ideal Pressure Primer

The Ideal model E primer illustrated herewith is designed to overcome difficulties in starting an engine in cold weather, thus saving battery current. The primer, which is attached to the dash, is connected with the feed line and the proper amount of gasoline is injected into the manifold of the engine just before cranking. The stem is threaded and when the primer is not in use a few turns of the handle will close the valve, making it impossible for the device to leak, even under pressure. The manufacturer states that this primer can be used from one season to another without attention, due to the use of two materials on the plunger to avoid the trouble frequently experienced by the leather drying out. Special furnishings for any car are provided and directions included with each primer, the price complete with tubing and all connections being $5.—Ideal Brass Works, Tenth Street and Canal, Indianapolis.



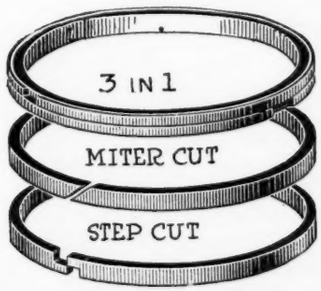
Ideal model E primer for overcoming difficulties in starting the engine

Fillometer for Fords

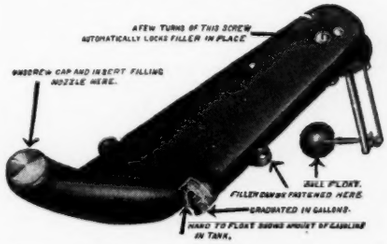
This device permits filling the gasoline tank of Ford cars without disturbing the occupants of the front seat. It consists of a metal casing that screws over the filler cap of the tank and fits flat under the seat cushion with its nozzle projecting past the edge of the seat. A gage is included that shows the amount of gasoline in the tank at all times.—Apex Electric Mfg. Co., 410 West Fifty-ninth Street, Chicago.

Stevens Non-Set Piston Rings

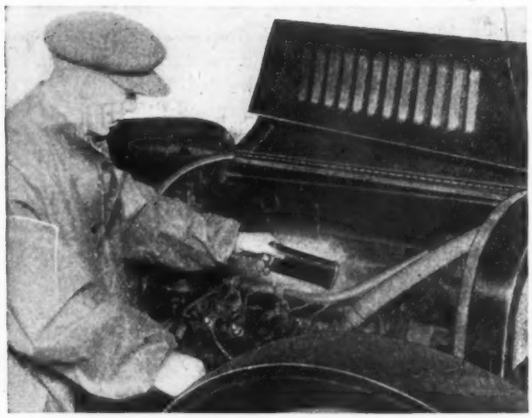
In these individually cast rings the natural skin of the casting is left in the finished ring. By the method of machining and polishing it is claimed that the resulting ring is extremely resilient and long-lived, making a gas- and oil-tight piston. Three styles of Non-Set rings are made—the miter-cut, the step-cut and the three-in-one. The latter is a compound ring made up of two narrow concentric rings lying on an inner ring in a manner that prevents any direct line for the gases to escape. Price,

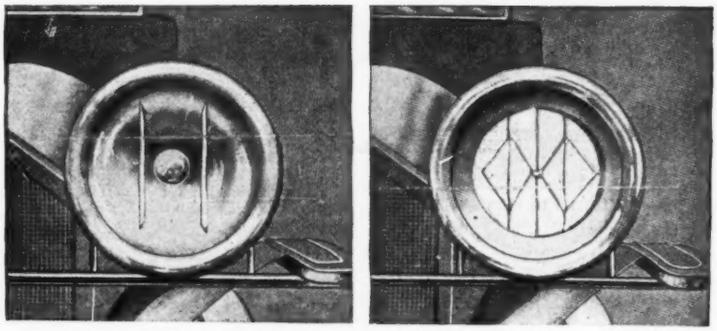


Stevens Non-Set individually-cast piston rings in the three styles made



Fillometer for filling Ford gasoline tank





Left—Hughes electric engine warmer for use in unheated garages. Above —Nodaz headlight dimmer, closed at left and open at right. The shutters employed in this device are operated by a push-button

miter-cut and step-cut, 25 to 40 cents each; three-in-one, $1 to $1.50, according to size and quantity.—Stevens & Co., 375 Broadway, New York.

Hughes Electric Engine Warmer

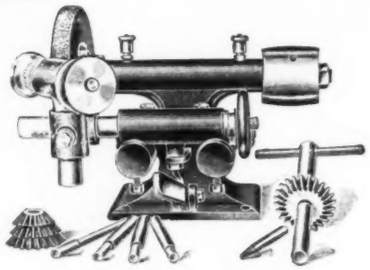
Engine and radiator are kept warm while in unheated garages by means of an electric heater operated from the lighting circuit. The heating element is inclosed in a metal case about the size of a dry battery, placed beneath the hood, and the hood and radiator covered with a blanket. The cost is said to be less than 1 cent per hour and the outfit well insulated and safe. Price, $4.—Hughes Electric Heating Co., 211 West Schiller Street, Chicago, Ill.

Walden Double Offset Wrenches

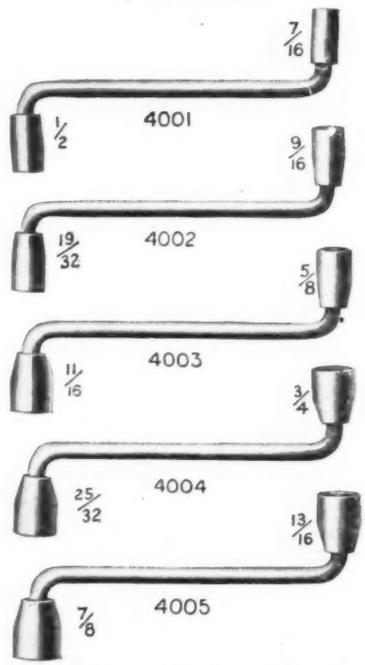
The sockets of these wrenches are placed at the end of a long handle that is bent in the form of a Z. These sockets are made of a solid steel bar, machine turned and broached to size. The handles are made of steel rod and have a length of 9 in. Price, No. 200 set, five wrenches, $2.—Walden Mfg. Co., Worcester, Mass.

Nodaz Headlight Dimmers

An electrically-operated translucent yellow shutter made in sections and installed in the headlight provides a dimming feature. When closed these shutters appear as narrow strips, permitting the searchlight beam of light to shine unrestricted. Pressure on a push-button near the driver's hand opens the shutters, causing the beams of light to pass through the translucent yellow material. Though giving a good driving light and a strong light at both sides of the road, glare is prevented, it is said. This company also makes a small rheostat for dimming headlights. Price, $10. —Ward Leonard Electric Co., Bronxville, N. Y.



Nasco valve grinder designed to secure any desired bevel



No. 200 set of Walden double socket offset wrenches

Nasco Valve Grinder

For grinding poppet-type valves to any desired bevel. A spindle, driven from an overhead shaft, carries a grinding wheel. The valve is carried in a swiveled chuck rotated by a small round belt, or, if desired, by hand. It is claimed to grind any valve to a perfect seat in 1 or 2 min., and not to require a skilled mechanic to operate it. Valve-seat reamer for refinishing the valve seats is also included in the set. Price, complete, $30.—National Auto Specialty Co., Tama, Iowa.

Bailey Muffled Heater

This heater is operated by the exhaust gases and is designed for either open or closed cars. The heater consists of a valve placed in the exhaust line between the engine and muffler. From here the gas passes through flexible tubing to a muffled seamless tube. The radiator lies flush with the floor and has an ornamented grilled nickel-plated surface. Price, $12 complete.—Riverside Machine Works, 228 Croton Avenue, New Castle, Pa.

No-Leak-O Piston Rings

The No-Leak-O piston ring is made of one piece. A groove is cut in the ring at right angles with the face and sloping downward for oil sealing. It is the oil sealing feature which is claimed to make the device proof against leaking. On the downward stroke of the piston the square edge of the ring will gather the surplus oil from the cylinder wall and pull it toward the oil pit. On the up-stroke the oil is distributed again on the cylinder wall from the sloping face of the groove. List prices range from 50 cents to $1.30, depending on the diameter.—Automobile Accessories Co., Baltimore, Md.

Bailey combined heater and muffler. It is easily and quickly applied

Industrial Miscellany

Factory

House Wire Wheel Co., Buffalo, N. Y., recently formed, is making arrangements for the erection of a plant for the manufacture of wire wheels for automobiles on a site recently acquired.

E. H. Sprague Mfg. Co., Omaha, Neb., has been formed to manufacture automobile accessories. It has taken over the plant of the Standard Foundry Co., that city.

Adams-Bagnall Electric Co., Cleveland, is completing an addition to its factory including a complete porcelain-enamel plant. Porcelain-enameled reflectors are largely used for industrial lighting.

Saxon Mfg. Co., Toledo, is planning to build a factory to manufacture automobile accessories.

Willard Storage Battery Co., Cleveland, has taken out a permit for interior improvements on its plant in this city. It will also build an $85,000 two-story plant, 135 by 222, at 280 East 131st Street.

Michigan Hearse & Motor Co., Grand Rapids, Mich., is building an addition to its plant. The addition is to be 100 by 60 ft. and will be devoted to the construction of bodies.

Specialty Mfg. Co., Minerva, Ohio, has been formed to manufacture automobile accessories. It will begin operations at once by the manufacture of an automobile light adjuster or tipper to be used in the place of a dimmer. Manufacturing will be concentrated in the Central Garage for the present.

Orrville Rubber Co., Orrville, Ohio, has started manufacturing tires and tubes.

Alpha Rubber Mfg. Corp. will locate in Genoa, Ill., to manufacture automobile tires and tubes. Up to this time the corporation has been selling a product manufactured expressly for it. Seventy-five employees will be worked in the new plant. J. A. Berger is president and general manager; Carl Schneider is vice-president.

Guarantee Tire & Rubber Co., Indianapolis, has been incorporated with a capitalization of $70,000 to deal in tires. The new company supersedes the Guarantee Tire Co. The officers are: G. F. Kreitlein, president; C. W. Minesinger, vice-president and treasurer, and Walter W. Kuhn, secretary. The company has taken over a five-story building at 214-216 McCrea Street for storage purposes.

Metallic Rubber Co., Columbus, Ohio, a subsidiary of the United States Rubber Co., did not open for operation Dec. 1, as was planned, because of delay in securing deliveries of machinery. The concern has taken over the former plant of the Midgley Manufacturing Co., on Dublin Avenue.

International India Rubber Co., South Bend, will begin the manufacture of automobile tires early next year. The first unit of the plant is nearing completion. The tread patterns for the tires to be manufactured by the company have just been patented.

Personal

Walter Woods and J. A. Clark are executives in the Van Cortlandt Vehicle Corp., New York Peerless representatives. Mr. Woods is vice-president and Mr. Clark is sales manager. Mr. Woods was formerly connected with the Peerless factory branch in New York. Mr. Clark managed the sale of the Peerless cars in New York for many years.

W. E. Heye, formerly with the Sharpleigh Hardware Co. of St. Louis, has been appointed traveling representative of the Gibson Co., Indianapolis, state Overland distributer and accessory dealer. He will have headquarters in South Bend, Ind.

Charles Campbell has been appointed manager of the used-car department recently installed by the Missouri-Haynes Co., Kansas City. He was formerly with the Moriarty Motor Co.

H. P. Nelson has been elected treasurer and sales manager of Robert Lurie & Co., New York, Metz representatives.

The Automobile Calendar

ASSOCIATIONS

Dec. 2-9—Electricians' Country-wide Celebration.
Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.
Jan. 9-11—New York City, Society of Automobile Engineers' Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.
Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.
Nov. 16—New York City, S. A. E. Meeting.
Nov. 23—Philadelphia, Pa., S. A. E. Meeting.
Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

1917
April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Dec. 2-9 — Springfield, Mass., Show, Auditorium, H. W. Stacey, Mgr.
Dec. 7, 8, 9 — Rockford, Ill., Rockford Automobile Trade Assn., Shrine Temple.
Dec. 9-16—Akron, Ohio, Show for Passenger Cars Only, Market Street Gardens, Akron Automobile Dealers' Show Assn.
Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel, I. R. Gates, Mgr.
Dec. 30-Jan. 6—Cleveland Automobile Accessory Show, Dreamland Auditorium.
Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.
Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.
Jan. 6-11—Milwaukee Auditorium, Milwaukee Automobile Dealers.
Jan. 6-13 — New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 12-20—Philadelphia, Show, Philadelphia Automobile Trade Assn.
Jan. 9-10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27—Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 20-27—Montreal, Que., Automobile Trade Assn.
Feb.—Newark, N. J., Show, First Regiment Armory.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12 - 17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 18 - 25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.
Feb. 19 - 24 — Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis Auto. Dealers' Assn.
Feb. 19-24—Syracuse, N. Y.; Show, State Armory, Syracuse Dealers' Assn.
Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.
March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co. Armory of the University of Ill.
March 3 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Automobile Trade.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.

Henry McLaughlin has been appointed factory manager of the Detroit plant of the Lewis Motor Corp. He was formerly superintendent for Golden-Belknap & Swartz.

E. H. Gertz will manage the Mount Vernon and New Rochelle branches of the Hudson Motor Car Co., New York. He assumed his new duties Dec. 1.

F. E. Dennison has joined the sales department of the Hartford, Conn., branch of the Packard Motor Car Co. of New York and will manage the used-car department.

H. S. Jackson of New York has gone to Portland, Me., to manage the Gilson Automobile Co., Mitchell agent.

J. A. Lamkin, formerly of Boston, Mass., has gone to Portland, Me., as sales manager for the D. E. McCann's Sons Co., agent for the Smith Form-A-Truck.

W. M. Williams has opened a general advertising office at 132 South Salina Street, Syracuse, N. Y. Mr. Williams during the past year was a member of the advertising department of the Willys-Overland Co., Toledo, and previously was the advertising manager of the Franklin Automobile Co. for 2 years.

Dealer

De Lion Tire & Rubber Co., New York, has moved to 1922 Broadway.

Saxon Motor Co., New York, has moved to 1744 Broadway. The old store at 251 West Fifty-seventh street will be retained for display purposes.

A. J. Picard, metropolitan distributor for U S L batteries and national distributor for the Genemotor, has purchased the interest of E. S. Morrison in A. J. Picard & Co. Mr. Picard has incorporated his business and will continue under the old name of A. J. Picard & Co. A five-story building is being erected at 9 West 61st Street, which will be ready for occupancy on or about March 1, 1917.

Everard & Oberting Co., Columbus, Ohio, will distribute Macon cars in central Ohio territory. Sales offices are at 140 West Blake Avenue.

E. B. Fidler, Marion, Ohio, has purchased the garage and sales agency of Hoyes & Moyer for a consideration of $50,000. The concern will have the Buick agency. It is located on East Center Street.

Crow-Elkhart Sales Co., Milwaukee, Wis., has been organized to take the Wisconsin and Upper Michigan distribution of the Crow-Elkhart line.

Frank Hanrahan has become state representative in Iowa for the Champion Ignition Co., Flint, Mich.

Auto Tire and Rubber Co., Seattle, Wash., has taken the agency in Western Washington for the Johnson shock absorber.

Mack & Saurer Truck Co. of Missouri, St. Louis, has been organized to handle the trucks named. Negotiations are under way for salesrooms and service station quarters. These trucks were sold by George C. Brinkman Motor Car Co., which recently closed up its affairs.

Kunkle Wagon Works, Baltimore, has taken the agency for the Interstate cars.

Homewood Motor Co., Baltimore, will handle the Abbott-Detroit.

Walbeck Tire & Rubber Co., Louisville, Ky., agent for the Racine tire, has moved into its new building at 305 East Broadway.

Metcalf-Ericson Motors Co., Louisville, Ky., agent for the Empire and Regal, has been appointed state distributor for the Stearns-Knight.

Stahl Automobile Co., Kenosha, Wis., has become a Buick dealer as successor to the agency held for several years by F. A. Rice.

Hallstead Messersmith Co., 310 Michigan Avenue, Buffalo, N. Y., has taken on the King line for Buffalo and vicinity.

S. E. Barnwell, who handles the King line in Louisville, Ky., has moved into new quarters at 813 Third Avenue.

W. C. Wampler Co., King distributor for Dayton, Ohio, has opened up new showrooms and service station at 132 North St. Clair Street.

Times Square Auto Supply Co. has established a western distributing store in Dallas, Texas.

Bearings Service Co., Detroit, has established headquarters at Dallas, Texas, for the Southwest. This is the selling company for the Hyatt Roller Bearing Co., the Timken Roller Bearing Co. and the New Departure Ball Bearing Co. Headquarters are in the new Masonic Building, Main and Pearl Streets.

The Southern Auto & Electric Co., Little Rock, Ark., will handle the Liberty car for the state.

J. V. Le Blanc, Jr., New Orleans, will become distributer of the Jordan. Mr. Le Blanc is a sugar grower at Thibodaux, La., where he sold cars at retail, and recently removed to this city

Val Rolle Wagon & Automobile Co., New Orleans, has entered the field as builders of commercial bodies for Ford chassis.

Burke-Court Motor Co., Memphis, Tenn., has been named distributer for Chevrolet.

Dixie Motor Sales Co., Memphis, Tenn., has succeeded the Franklin Motor Sales Co. and will handle Franklin, Crow-Elkhart and Cole 8 and Gramm-Bernstein trucks.

Shartenburg & Robinson, a New Haven, Conn., department store, has taken on the agency for the Jordan car and a model has been placed on exhibition on the main floor of the store.

Todd Rubber Co. has established a branch in Bridgeport, Conn., and in addition to handling Kelly-Springfield tires will stock accessories. C. E. Minnerly is manager. The concern has branches in New Haven, Ansonia, Danbury, Hartford, New London and Waterbury in addition.

McQuay-Norris Mfg. Co., St. Louis, has made a number of changes in its representatives. L. H. Dally has succeeded H. G. Paro as Chicago manager and the Chicago office has been moved to 1140 S. Michigan Boulevard. Dally has been chief of the McQuay-Norris field force of engineers up to the present. H. W. Sweeney has succeeded J. W. McKeen as manager of the Pittsburgh branch office. R. W. Long has been transferred from the field force of engineers to be manager of the Denver branch. He succeeds H. W. Sweeney.

New Orleans branch of the Goodyear Tire & Rubber Co. is installed in new quarters at 818-20 Howard Avenue.

A. Meyers' Sons Co., Richmond, Va., for many years prominent in the wagon and carriage trade, has been appointed Ford agent. This firm also operates an accessory store at 325 West Broad Street.

Sterrett & Fleming, Washington and Baltimore, has opened a branch in Richmond to show Detroit electric cars and Philadelphia grid batteries.

Arkansas Reo Co., Little Rock, Ark., has been named state agent for the Scripps-Booth.

Patterson Harness Co., Little Rock, Ark., has obtained the state agency for the American tires.

Auto Tire Co., Hartford, Conn., has taken on the Faure tire.

John Millen & Son, Ltd., Montreal, Que., has been appointed distributer for the Boyce Moto-Meter.

P. C. Meredith, Des Moines, state distributor for Bull tractors, has taken the agency for the Dort, and will also distribute the Hercules truck. The new firm is called the Meredith Motor Car Co.

R. W. Llewellyn has been appointed manager of the Columbus, Ohio, branch of the Kelly-Springfield Tire Co.

O'Rourke-Muller Motor Co., New Orleans, has secured the agency for the Elcar and the Ames Ford attachments. A salesroom and service station will be opened at 824 Barronne Street. Temporary offices are at 853 Carondelet Street.

George A. Loque, Jr., New Orleans, distributer of the Hal cars, has opened a salesroom at 640 Barronne Street.

Goodyear Rubber & Tire Co., St. Louis branch, has moved into its new quarters at 3010 and 3012 Locust Street.

National Motor Co., Denver, National, Elgin and Wescott distributer for Colorado and Wyoming, with headquarters at 1616 Broadway, has dropped the Wescott and is now handling only the other two lines.

Northwest Mercantile Co., Kremmling, Col., has secured the Dodge and Velie agency for Grand, Summit and Eagle counties.

Wm. Thorney Auto Co., Denver, Apperson and Regal distributer for Colorado and Wyoming, with headquarters at 1315 Broadway, has gone out of the selling business and expects to start a garage as soon as a suitable location can be secured.

Estabrook-McGraw Tire Co., Denver, is a new tire-distributing agency for Colorado and extensive adjacent territory in the Rocky Mountain region for McGraw tires, with headquarters at 1646 Broadway. The new firm is headed by G. H. Estabrook, Hollier and Briscoe distributer and proprietor of the Estarado Garage.

The King Motors Co. has leased the premises at 2813 Locust Street, St. Louis, Mo., vacated by the Brinkman Motor Car Co., for a factory branch. William Schreiber, who has been connected with Paige, Premier and other distributing agencies here, will be manager. A service station carrying a complete set of parts will be opened in charge of a factory expert.

Nichoalds Co., Detroit, for many years dealer in automobile parts and accessories, has entered extensively into the jobbing business.

Kaehler Motor Car Co., Richmond, Va., has started a fall competition in sales by offering a free trip to the New York automobile show to the employe making the best showing between Nov. 1 and the date of the show.